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AUSTRALIA WITH Professional Electronics & ETI

FEBRUARY 1998

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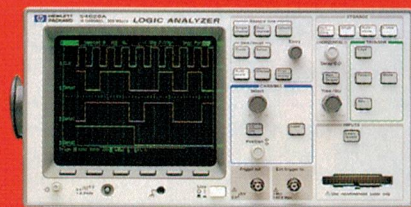
HP 970 - series:
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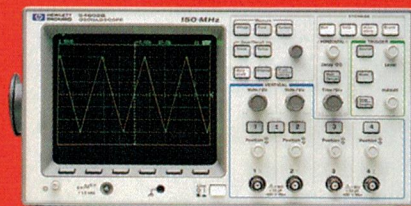
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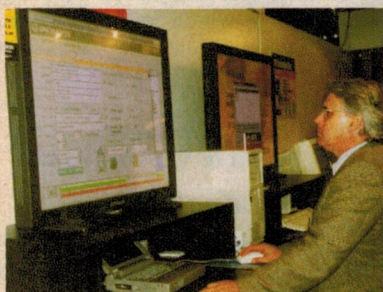
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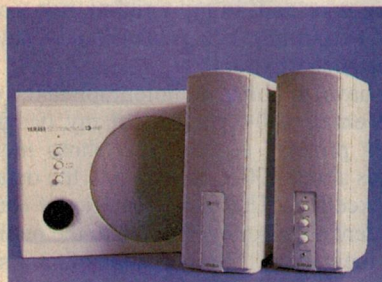
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

"10,000 new products..."



Our US correspondent Paul Swart says that with about 10,000 new products released at the recent Comdex show in Las Vegas, it wasn't easy to pick out all of the trends. But recordable DVDs certainly seem to be shaping up for a VHS/Beta type marketing battle, as he explains in his report starting on page 12...

Multimedia PC speakers



To get really satisfying sound from a modern 'multimedia' PC, you need good speakers — like Yamaha's new YST-M15/YST-MSW10 powered full range system. Reviewer Louis Challis has been testing this system, and reports on what he found in his review starting on page 10.

On the cover

Graham Cattley's new Cable Break Finder project should be a real boon for anyone who works with a lot of cables, because when you have a broken conductor it can indicate where the break is located, along the cable's length. Graham explains how to build it, in his article starting on page 42. (Photo by Michael Pugh)

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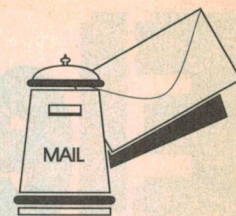
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LETTERS TO THE EDITOR



Philips on DVD

Regarding your editorial on DVD in the November issue, I would like to update some of your comments. In essence, marketers of both software and hardware as well as movie studios have agreed on issues which arose when the new medium was under development. Specifically:

1. You mention arguments about double-sided or dual-layer disc formats. This was the situation nearly two years ago. DVD discs are double-sided and capable of holding a full length movie and other information such as sub-titling and multiple languages.

2. The copyright issue has also been resolved and to the best of our knowledge, all major studios are prepared to release titles on DVD.

3. In regard to regional coding of discs, this was agreed upon by everyone in the consortium releasing DVD — that is, the movie studios and manufacturers of players.

4. There is no argument between manufacturers regarding MPEG 2 and Dolby Digital AC3. The specifications have been agreed upon. Software is encoded with both to allow for different broadcast standards in different countries.

5. You say Philips and Sony have decided to break away and develop their own formats. This comment relates to DVD recording, the specifications for which are still under discussion. This is a normal process in the development of standards for new equipment.

6. The studios in the US have not developed a competing type of DVD format. There is however, one retailer in the US who is selling DVD software which connects via modem back to their own website. This is known as DVX. This system does not have the support of the DVD Consortium.

Philips has now released DVD decks on the Australian market as has some of its competitors. Consumers can buy or rent a growing range of titles from Roadshow and Simitar.

At Philips, we are confident DVD will be successful. Experience in the US already indicates this with sales of DVD in just six months surpassing that of VHS Video which took two years to

reach a similar level. The boom in the growing home cinema market will further reinforce the success of DVD. Research suggests there is a boom in the sales of large screen TVs and Pro Logic sound systems, which indicates to us a demand for top quality, digital pictures to match.

Anthony Toope

**Senior Product Manager,
Philips Sound & Vision, Sydney.**

Our image quality

The second half of your editorial in the Nov. issue of *EA* confirms my suspicions. I have noticed a marked deterioration of the picture quality of the mag recently and now I know that you are using a digital camera. If you turned up at an important product launch with a \$15 plastic camera, bought from the supermarket, people would laugh at you, but that is about the standard of quality you get from a current digital camera.

The standard of quality of the pics that Tom Moffat e-mails with his articles is very poor and, in my opinion, not worthy of putting in a professional magazine such as yours.

I have, at home, a photograph taken of the entire 250+ students at my daughter's primary school. The photo measures about 400 x 200mm and the detail is excellent. The facial features of each student are clear even down to the pupils of their eyes. The pic was, of course, taken professionally on fine-grain film. Such a picture would be impossible with a digital camera.

Do yourself and your readers a favour, Jim, and go back to using high quality film photography and restore the pictorial quality you once had in an otherwise EXCELLENT magazine. I thought that technology was supposed to improve the standard, not reduce it.

Ray Chapman (by e-mail)

Australia's loss

Thank you for the positive response to my email regarding *EA* reviewing the QPSX SafeGuard Executive product.

Unfortunately QPSX's owner, Telstra has got in the way. QPSX is 100% owned by Telstra. Telstra has been trying to sell QPSX for quite some time.

Research, development and sale of Australian communications products is not considered to be a desirable activity by Telstra, nor apparently, by Telstra's owners, the Australian Government.

The sale of QPSX was very nearly complete when the buyer pulled out of the deal. QPSX development and sales activities have been frozen by Telstra management since the beginning of this year. This naturally led to cash flow problems and the buyer did not want to buy a company with this problem.

Telstra's response was to immediately order the retrenchment of half the staff in QPSX. As you may guess this has decimated the company. It is going to take some time to recover from the situation, and unfortunately we just do not have enough people at the moment to spare on product marketing activities.

I still have hope for the SafeGuard product. I know at least one foreign organisation is keen on getting hold of the intellectual property that went into its design. Ideally an Australian company would buy the rights to the product from QPSX/Telstra and take the product to market. But second best, the efforts of the team at QPSX might be used to profit a foreign company; at least we'd have the satisfaction of knowing that the team's effort was acknowledged by someone.

It's a tragedy that such an excellent engineering team has been wiped out. It makes me sad to be an Australian at times like this.

John Leiseboer (by e-mail)

Digital pay TV

I'm writing in response to the letter from Leigh Hauber in your September issue. There is in fact a supplier of DSS in Australia. That's Galaxy Pay TV. They've been selling a digital satellite service since the middle of 1996 at least. That's when I got connected up to their satellite service. I'm surprised you weren't aware of their existence.

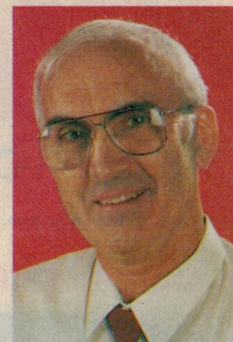
The Galaxy signal comes via the Optus B3 satellite and is encoded as MPEG2 so it carries encoded Pro-Logic information. The signal is received in a dish, about 70cm across mounted on my roof. The picture quality is brilliant.

Fred Willett

Paralowie, SA. ♦

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Who are the 'living treasures' of Australian electronics, do you think?

The day before I sat down to write this editorial, *The Sydney Morning Herald* published the results of a poll conducted in conjunction with the National Trust, where some 10,000 readers sent in their lists of the people they believed were most entitled to be called an 'Australian National Treasure'. There were 100 people who made the list, all of them highly regarded for their achievements and without a doubt well qualified to be regarded as living national treasures.

Perhaps it wasn't all that surprising, in view of the largely 'back room' nature of electronics, but there was really only one person on the list who had been in any significant way associated with electronics: my erstwhile boss, Dick Smith. It was great to see Dick honoured in this richly-deserved way, but at the same time I couldn't help thinking about some of the *other* people in Australian electronics, who might also be worthy of being honoured as 'living treasures' — if we were able to focus on just this area of activity.

One name that came immediately to mind is Neville Thiele, famous around the world with Richard Small for their joint achievement in establishing the design procedures for loudspeaker enclosures. Neville has also played key roles in the development of Australia's television system, and has inspired generations of engineers and technicians through his work with the IREE (Aust.) and the AES. As anyone who's ever had the honour to meet him will testify, he's also one of nature's true gentlemen and a delightful raconteur — so he'd certainly have *my* vote as one of the living treasures of Australian electronics, and I suspect those of many others as well.

Many other names sprang to mind as well: Arthur Spring, rightly famous for his 'lean, mean and reliable' equipment designs at Jackson Brothers; Heather Harriman, the long-time executive director of the IREE (Aust.), with her legendary diplomatic and negotiating skills; Lou Davies, former chief scientist of AWA and professor at UNSW, and also a great teacher; Geoff Wood, who helped so many people over the years at Radio Despatch Service and Geoff Wood Electronics, with his boundless enthusiasm and encyclopedic knowledge of components; Murray Stevenson, who was founding chief engineer of ATN Channel 7 and served on the IREE Council for many years; and so on. (Sorry if I haven't mentioned *your* name!)

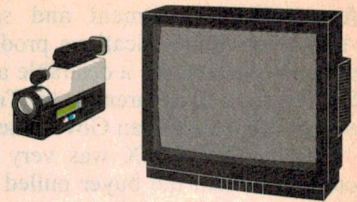
When you think about it, there really are a great many people who undoubtedly deserve to be honoured as living treasures of Australian electronics. So why don't we conduct our own survey, and see which people *we* can collectively honour in this way?

How about writing down the names of say the 10 people that *YOU* believe should be on such a list, together with a brief summary of what you see as their most notable achievements and why you see them as a 'treasure'. Send them to me by the end of the month (February 27), and we'll do our best to publish the names of the 10 people who receive the most votes, in our May issue.

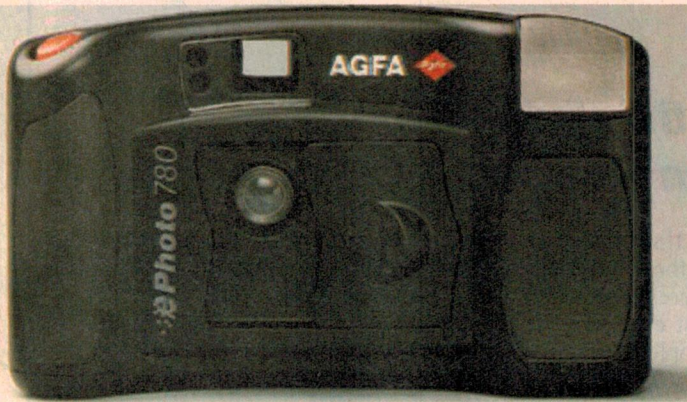
Jim Rowe

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS



New digital camera from Agfa



Another release at Comdex was Agfa's ePhoto 780, a new and very fast point-and-shoot digital camera aimed at meeting the demand for superior image quality at a low price.

The ePhoto 780 uses what Agfa calls PhotoGenie technology to achieve 1024 x 768 pixel (XGA) image resolution from the camera's 350,000 pixel CCD sensor. PhotoGenie apparently enhances images as they are downloaded to the computer, using artificial intelligence techniques to produce images which rival the quality of those captured with more expensive XGA cameras.

In addition to PhotoGenie, the ePhoto 780 is claimed to set a new standard in image processing performance — typically only one second per image. It includes a 1.8" colour LCD for accurately framing shots prior to capture and for reviewing them once they have been stored on the included 2MB SSFDC SmartMedia card. The card stores between eight and 96 images, depending on capture mode. There's also a video output (switchable NTSC/PAL) for viewing images on a TV.

The street price of the ePhoto 780 in the US is US\$499.

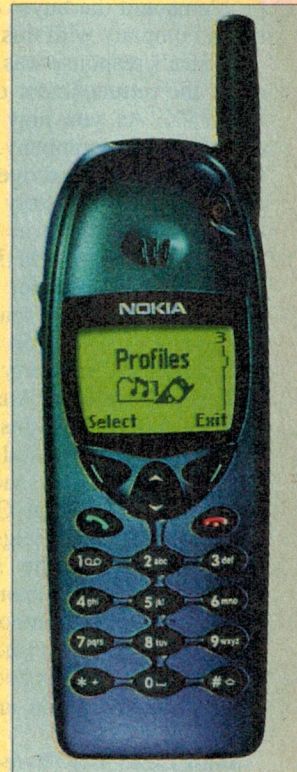
Nokia cellphone offers 'profile settings'

Nokia's new model 6110 'flagship' cellphone offers advanced features, including 'profile settings' which allow the user to allocate different and distinctive ring tones for different callers, and in different situations. Nokia claims it's the first mobile phone that adapts to 'all aspects of modern life'.

When combined with priority grouping, the profile settings give the user the power to select the calls they wish to put through. The 6110 comes equipped with 'family', 'VIP', 'Friends', 'Colleagues' and 'Other' caller group settings, allowing the grouping of different callers with specific ringing tones to allow easy identification.

The unit is also claimed to set industry standards in terms of efficient battery usage and performance, with 60 - 270 hours of standby time on the slim Lithium-Ion battery and 100 - 450 hours using the extended Lithium-Ion battery.

The Nokia 6110 offers all three voice codecs available in GSM today — Enhanced Full Rate, Full Rate and Half Rate. Nokia claims to be the first manufacturer to offer all three codecs in one phone. An infrared connector also allows phone-to-phone transfer of names, phone numbers and messages as well as printing of phone book entries.

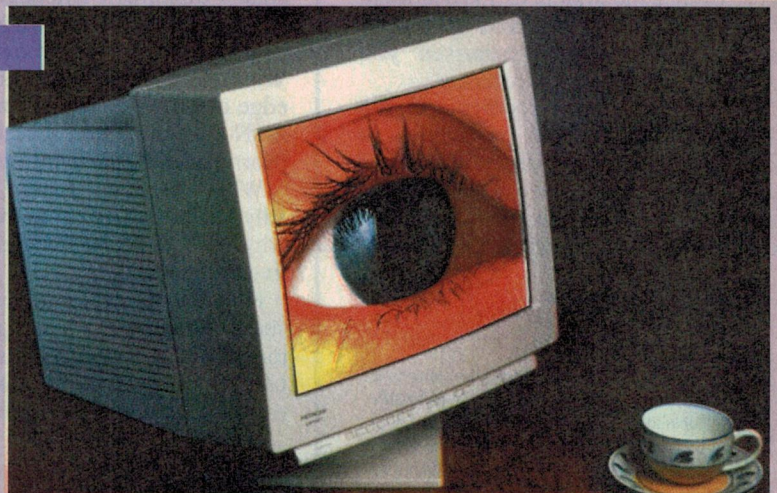


Hitachi provides 19" PC monitor

Hitachi Australia has released a new high quality 19" colour monitor for desktop PCs, the CM751, which is claimed to offer performance very close to that of expensive 21" monitors, but with a price and desk area closer to that of existing 17" monitors.

The Hitachi-developed CRT used in the CM751 provides a viewable screen area of 367 x 276mm with 0.22mm dot pitch and an Invar shadow mask for high brightness and precise focus right to the screen edge. The monitor boasts a maximum resolution of 1600 x 1200 pixel at 75Hz refresh rate and 1024 x 768 at an industry leading 115Hz refresh rate.

The Hitachi CM751 is available from Hitachi monitor dealers Australia wide, with an RRP of \$2660 including tax. For further information circle 145 on the reader service card or contact Hitachi at 13-15 Lyonpark Road, North Ryde 2113.



VHS camcorders with swing-out LCD monitors

Panasonic has updated its range of compact VHS-C camcorders with LCD screens. The three new models (NV-VX10, NV-VX30 and NV-VX70) have both a swing-out colour LCD screen and black & white viewfinder. The VX10 and VX30 models have a 76mm (3") colour LCD monitor while the VX70 has a 100mm (4") monitor.

Panasonic claims the LCDs have a non-glare silica-coated screen which resists fingerprints and dirt, and easily wipes clean. Multi-angle shooting is possible because the LCD monitor swivels up or down over a 270° range.

There is a built-in speaker with volume control on each of the cameras for instant playback. They also feature a multi-language titler which includes 10 phrases such as Happy Birthday and Merry Christmas. The base model VX10 has a 17x optical zoom, while the VX30 and VX70 augment this with a 200x digital zoom.

The VX30 and VX70 also include a range of creative digital functions including digital wipe, digital mix, sepia, black & white, solarisation, negative, strobe and gainup.



RRPs for the new camcorders range from \$1699 for the NV-VX10A to \$2199 for the NV-VX70A. For further information circle 140 on the reader service card or contact Panasonic's Customer Care Centre on 132 600.



Solar two-seater:

It's a car, Jim — but not as we know it! The ultra-light vehicle at left has been developed at Halle University, in the former East Germany. With a roof formed by three photovoltaic panels, it uses both solar and pedal power to reach a dazzling top speed of 25kph. The steering looks a little tricky, though...

Portable CB from Icom

Icom says its new handheld CB Traveller combines features required by those who want a CB, a commercial radio or both. It offers 40 channels to the UHF CB enthusiast, plus a further 20 commercial channels for the licensed operator who needs a commercial radio for business purposes. (The commercial channels must be programmed by an Icom-approved dealer.)

The CB Traveller features CTCSS — the most basic popular signalling system which has 51 frequencies available. A pocket beep function can

alert you to signals received from specified stations, so the unit is quiet until programmed stations call. An inbuilt alarm beeps (similar to a pager) when such a signal is received.

Compact, lightweight and easy-to-operate, the CB Traveller features a rugged diecast frame. The antenna terminal is a durable screw-in type to minimise loss of antenna connection. An optional battery case means the CB Traveller can be powered by standard AA NiCad or alkaline batteries if a battery charger is not available.

For further information circle 146 on the reader service card or call



Icom on (03) 9387 0666 or free call 1800 338 915.

Windows CE handheld boasts largest screen

At the recent Comdex show NEC Computer Systems Division revealed its new MobilePro 700 Handheld PC, claimed to have the industry's largest keyboard and LCD display in a handheld PC based on Microsoft's Windows CE 2.0.

The MobilePro 700 offers a comfortable 'finger friendly' keyboard, with a key pitch of 16.1mm for easy word processing and email while on the road. It also features a large 185mm (7.3") diagonal backlit touch-screen display with stylus, for clear, easy viewing.

So that the mobile professional can download and synchronize PC-based PIM applications and files for wireless file transfer between their desktop or notebook and the MobilePro 700, it includes an infrared IrDA port for file transfer and printing at speeds up to 115.2kb/s. A serial port is also included for a quick direct



connection, along with a 33.kb/s hardware modem for high speed e-mail, faxing and Web browsing on the road.

The MobilePro 700 is equipped with both a Type II PC card slot for the easy addition of peripherals, and a compact

flash memory slot, for added storage. The internal memory can be expanded to 32MB.

The NEC MobilePro was released in the USA in December, with a street price around US\$699.

High quality car speakers are two-way

Even more so than with other audio systems, the speakers are critical to the quality of sound achieved by a car hifi system. Pioneer claims its new TS-E Series of flush mounting two-way speakers offer superior quality at a reasonable price.

The new TS-E1670/1370/1070 designs are designed to address the heavy demands of wide dynamic range from many of today's digital sources, such as CD. The TS-E1670 is 160mm in diameter, while the TS-E1370 and TS-E1070 are 130mm and 100mm respec-



tively, with a rated power handling capacity of 150W, 100W and 80W.

The speakers boast a sensitivity of 91dB/W/m (90dB for the E1070) and

each has an impressive frequency response: 30-30,000Hz for the E1670, 40-30,000Hz for the E1370 and 45-30,000Hz for the E1070. They use cones of injection moulded polypropylene, nickel coated to improve rigidity in all directions, coupled to butyl rubber surrounds for elasticity and stability during large cone excursions. The end result is claimed to be much deeper bass response, while offering high internal loss to regulate midrange response.

RRP's for the speakers are \$189 for the TS-E1670, \$169 for the TS-E1370 and \$149 for the TS-E1070. For further information circle 143 on the reader service card or contact Pioneer car audio products on 1800 338 439.

AV receiver includes Dolby Digital (AC-3)



Pioneer's new VSXD736S home theatre audio/video receiver includes both Dolby Digital (AC-3) and Dolby Pro Logic Surround decoding, yet carries an RRP of only \$1499.

Dolby Digital (AC-3) provides the most advanced home theatre sound available, and the VSX-D736S has the Dolby Digital (AC-3) decoder supplemented by five equal power (60W) amplifier channels. It also provides preamp outputs for additional centre channel, front channels and subwoofer channels.

An inbuilt DSP (digital signal processor) supplements the 'Dolby' features. It processes Dolby Digital sig-

nals in digital form, controls the steering logic of Dolby Pro Logic Surround for precise localisation, and adds to the sound field by creating reverberations and reflections.

An additional feature is what Pioneer calls its ISC (Intelligent Control System), featuring a multi-operation 'Smart Remote' preprogrammed to control other Pioneer SR (System Remote) audio and video components, and with the ability to learn functions of most other infrared remotes. ISC also features Multi-Operation Commands that facilitates one-key-touch operation.

For more information circle 141 on the reader service card or call Pioneer on 1800 060 852.

CD recorder for home users



Plain paper fax uses thermal printing

Targetted at the SOHO market, Panasonic's new KX-F1010AL compact plain paper facsimile machine is 40% smaller than its predecessor at 367 x 255 x 149mm. It uses thermal transfer to print the image on the page, even though it uses readily available A4-size plain paper the same as that used in a photocopier.

The KX-F1010AL's memory can store 28 pages of incoming faxes to cover out-of-paper situations, and can also hold up to 28 pages in memory for transmission at a later time. The memory also allows it to send a multi-page document to up to 117 locations sequentially.



Another nice feature is a 'paper save' mode, where it will print out incoming fax messages at half their original size, printing two pages to every A4 sheet.

The KX-F1010AL has 64-level halftones, copier function, 18 one-touch memory and 100 additional memory positions, automatic redial and is compatible with Telstra's Faxstream-Duet service. It carries an RRP of \$699.

For further information circle 144 on the reader service card or contact Panasonic's Customer Care Centre on 132 600.

The new Philips CDR-870 CD recorder connects easily to any existing home audio system and allows users to record from virtually all analog or digital audio sources. It allows anyone to create and play CD quality recordings which are fully compatible with the existing audio CD format.

Needless to say the recorder conforms to agreements made worldwide on copy protection like SCMS, the Serial Copy Management System, and as a result will not allow multiple copying of copyright material.

Philips says the CDR-870 is currently the only audio recorder which is compatible with both CD-Recordable and CD-Rewritable media. CD-Recordable discs can be 'written once', meaning that a disc can only be created once. These discs can then be played on any CD audio player. CD-Rewritable discs can be 'written and rewritten', so tracks can be erased and re-recorded as often as needed.

CD-Rewritable discs currently will not play on existing CD-audio players. However, Philips has said it will make CD audio players compatible with CD-Rewritable discs starting this year. Blank discs, CD-R and CD-RW, are already widely available and in use in the personal computer world.

The CDR-870 carries an RRP of \$1495. The recordable CDR discs are \$14.95 each, while the CDW rewritable discs are \$54.95.

Phone cards feature Dilbert & friends

Cartoonist Scott Adams' Dilbert comic strip is extremely popular around the world, currently appearing in more than 1700 newspaper in 51 countries. It even has its own Web site — a page called 'The Dilbert Zone' on <http://www.unitedmedia.com>.

Now US telecommunications giant MCI has signed a licensing agreement with United Media, and has launched a series of pre-paid phone cards depicting

Pioneer's 25-CD 'Diskmaster' is back...

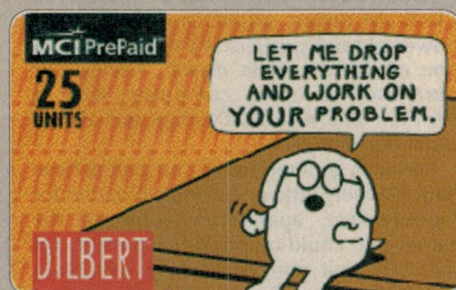
Although it was very popular when first introduced, for reasons best known to Pioneer its PD-F25 low cost 25-CD Diskmaster soon became unavailable. However due to 'popular demand' the company is now offering it again, at an RRP of only \$249.

Dubbed the 'friendly little organiser', the PD-F25 can be added to any existing system or component system to give the ability to play over 30 hours of uninterrupted music. You can program up to 32 selections to be played in any order, or you can play music at random.

Designed to be 'heard and not seen', the unit comes complete with remote control so you can position it wherever you like. Discs are stored dust-free behind a smooth-opening power door, listed by artist or music type, and can be selected at a touch of a button on your remote.

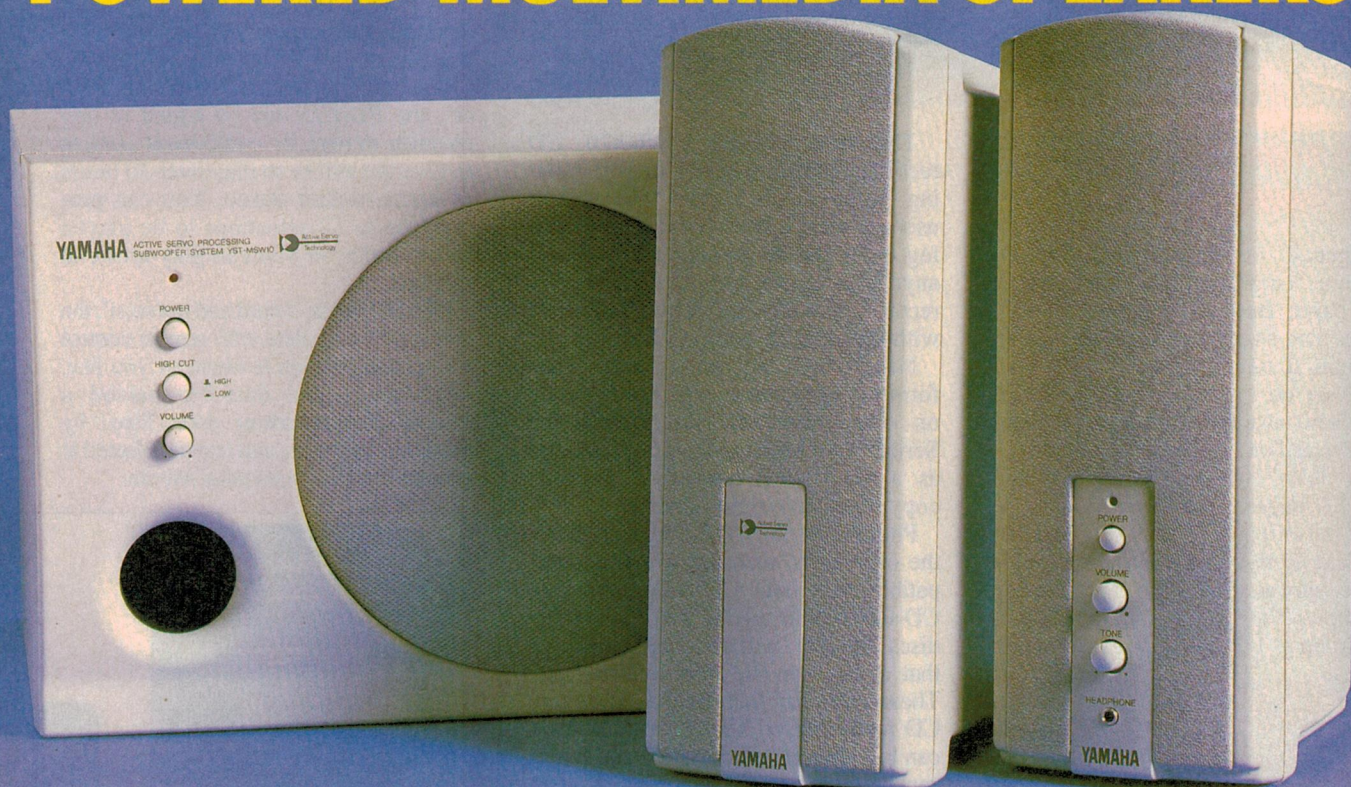


The PD-F25 uses Pioneer's single-bit Direct Linear Conversion Technology. For further information circle 142 on the reader service card or contact Pioneer on 1800 060 852.



Dilbert, his office colleagues and pet Dogbert. MCI expects the cards to become their most popular series. ♦

YAMAHA YST-M15 & YST-MSW10 POWERED MULTIMEDIA SPEAKERS



Looking for a good add-on speaker system for your new multimedia computer setup? It's surprising what this can achieve in terms of improved sound quality and impact — as our reviewer Louis Challis found when he tried out Yamaha's new YST-M15 powered midrange enclosures and their matching YST-MSW10 powered subwoofer.

In the last year, tens of thousands of us in Australia and New Zealand have invested in new 'multimedia' computers incorporating the latest generation of MMX Intel chips. The majority of buyers of such systems have been offered multispeed CD-ROM drives, sound cards and mains powered loudspeakers. As it happens I'm one of those people myself, having just purchased a new computer with a Pentium 233MHz MMX chip and all the usual peripherals...

Previous generations of computers have had relatively little need or justification for loudspeakers, apart from some of the games that could be played or possibly for the CDs that you could play with your CD-ROM drive. But towards the end of 1996 and throughout 1997, there have been some remarkable developments in computer technology, and particularly with the new MMX generation of comput-

er chips which are optimised to handle MPEG 2 software encompassing both video and audio.

I have already played a number of composite audio/video CD-ROM discs using my new computer, and I expect that within the year, like many many others, I will install an alternative DVD-ROM drive to provide me with the ability to play and view DVDs which have been formatted for Australian conditions.

The system I bought came with a top flight Sony Multi-Scan 200SF monitor, which is ably suited for the task. But the pair of speakers I purchased, although passable, are probably typical in that they fall short of the standards that we've come to expect for listening to quality music via our home music systems.

Quite a few speaker manufacturers have realised that there is a burgeoning market for new computer-based products,

to remedy this problem. One manufacturer in particular, Yamaha, has developed a range of new products which provide practical and cost-effective solutions. A good example of the quality you can expect from these products is given by their latest powered multimedia speaker system, the YST-M15 midrange system and its matching YST-MSW10 subwoofer.

At our request Yamaha kindly provided us with a set of these speakers to evaluate, and it was very interesting to put them through their paces.

The YST-M15 speakers come as a pair, one of which incorporates two amplifiers as well as volume and tone controls. The second speaker of the pair only has a socket to accept the drive signal from the main unit. Rectified DC power is provided by an external DC power pack, which provides 14 volts to the amplifier modules.

By the way, it's possible to buy only the

YST-M15 powered multi media speakers without the subwoofer system. However this would provide a frequency response which extends from approximately 150Hz to 7kHz, above which there's a fairly ragged, but useful response up to approximately 15kHz.

Of course the preferred approach is to complement the YST-M15's with the YST-MSW10 subwoofer, to fill in the bottom end properly. This is the approach emphasised by Yamaha's marketing, and to increase its appeal they currently sell the complete system including the subwoofer for just \$299.

When correctly adjusted, the effective frequency response of this complete system extends all the way from 40Hz to beyond 10kHz. As I discovered, it provides a level of fidelity which is quite audacious when you consider both its modest size and more specifically its very reasonable cost.

Setup & testing

I initially evaluated the composite system in my anechoic chamber, with the on-axis frequency response measurements being performed at 1m. Then I took the two systems home, where I installed them as an integral part of my computer system.

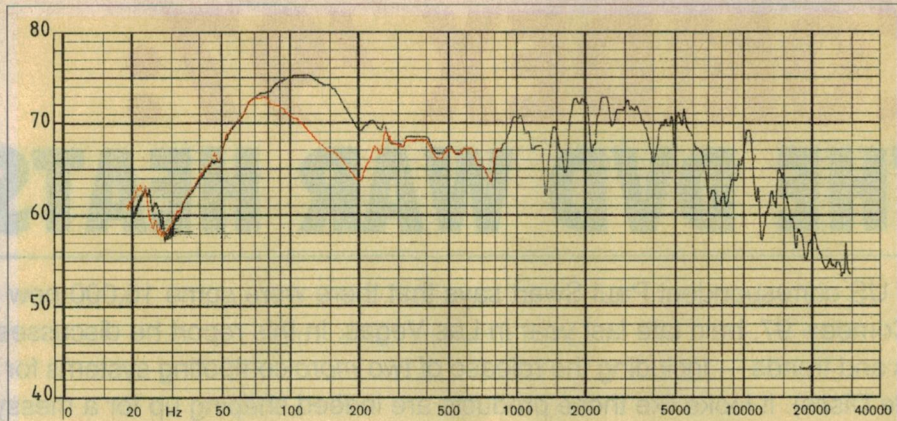
At this stage I can perhaps give my first impressions: when the YST-M15s are placed on both sides of the computer screen, they provide excellent stereo imaging. With a 10 watt peak power input capability to each enclosure, they provide a 'more than adequate' output level, spaced less than 1m from my head.

The YST-M15s are neat, relatively small and slim modules, designed to flank your computer's video monitor. The right-hand speaker is designated as the 'master' unit and it contains the dual 10W amplifiers, together with the other functional controls. The front panel has a narrow rectangular inset at its base on which are mounted the power ON-OFF switch, a small rotary volume control and a tone control (providing high cut).

The panel also incorporates a miniature stereo headphone jack socket, for private listening — perhaps late at night, when the other members of your household are asleep.

On the master speaker's back panel, further miniature stereo jack sockets are provided for an 'adjustable' input (with its own miniature level control potentiometer), and similar outputs to serve other circuits or sound systems. A bulky 14V double insulated DC power pack which provides 800mA of current for the amplifiers is designed to sit on the floor. The power pack sensibly incorporates a 2m long mains lead, as well as a 2m long DC output lead with a polarised plug at its output end.

I hooked up my new computer audio outputs into the shoebox-sized YST-MSW10 subwoofer's input. I set its volume control to its mid-range position and placed it under my desk. It has only three front panel controls: a mains switch, a volume control and a pushbutton to select



Measured frequency response plots for the Yamaha YST-M15s and YST-MSW10 combination, with the subwoofer's High Cut switch in the 'High' (black) and 'Low' (red) positions. Subjectively the latter sounds more balanced.

HIGH CUT (Low/High) for the output lines feeding the main stereo speakers.

The YST-MSW10's back panel provides the option of either miniature or standard 6.5mm stereo jack sockets for the INPUT/OUTPUT circuits. The provision of these two options is a definite plus, and it materially assisted me in providing connections to other conventional systems for my later comparisons.

It took me less than two minutes to set up the three speakers, and I found that Yamaha's instructions were simple and concise.

How it went

I subjectively evaluated the composite system's low frequency peak output and its distortion capabilities, firstly with pure tones and then with one-third-octave band filtered pink noise signals.

I quickly discovered that irrespective of which type of input signals you use, if the dominant frequencies are below 60Hz and capable of providing a useful volume, then frequency doubling and unacceptable levels of distortion are immediately apparent. At frequencies above 65Hz, the output is relatively clean and quite acceptable. More importantly, output levels of up to 100dB are achieved at the normal listening position with an overall impressive performance.

Progressing to music CDs, the first disc I played was Ottmar Liebet's 'Learning Into the Night', with an exciting repertoire of modern guitar music (Sony Music ASK63105). The three-speaker system performed far better than I would have expected, particularly when I selected the subwoofer's HI CUT switch to operate in the low position. In that position, the YST-M15s provided a noticeably better balanced and far more natural sound output.

I then experimented with more classical music from 'Opera Nights' (Emporio DEM-PCD 027), with selected opera highlights on two discs. The music came alive, and I was positively surprised at the quality of the vocal sound reproduction. I left my computer desk and walked to the end of my listening room — where I was even more sur-

prised to find that the balance, presence, and acceptable stereo imaging was still evident at four metres from the speakers.

At that stage I separated the main speakers to conform to a more conventional 1.5m spatial separation, and played another disc: Bartok's 'Concerto for Orchestra' with Esa-Pekka Solomon leading the Los Angeles Philharmonic Orchestra (Sony SK62598). Here I was again delighted to find that these three little speakers could provide a broad and effective sound stage out of all proportion to either their size — and more importantly, to their price.

So summarising, the Yamaha YST-M15s when combined with the YST-MSW10 subwoofer provide a truly impressive performance. If they can impress me so readily, then I believe this is a good indication that they'll impress you too. At a \$299 selling price, they surely constitute excellent 'value for money'.

For the record, the model YST-M15 enclosures measure 245 x 155 x 94mm (HxDxW), and each weigh 1kg. The matching model YST-MSW10 powered subwoofer measures 200 x 259 x 280mm (HxDxW) and weighs 5.5kg. For further information circle 200 on the reader service card or contact Yamaha Music Australia. ♦

Yamaha YST-M15/YST-MSW10 multimedia speakers

A powered speaker system to achieve more satisfying sound from multimedia computer systems. Includes midrange speakers and a matching subwoofer.

Good points: Very impressive sound quality, considering the system's compact size and very reasonable price. Excellent stereo imaging at the usual spacing on each side of a monitor.

Bad points: Some distortion evident if there's significant signal content below 60Hz.

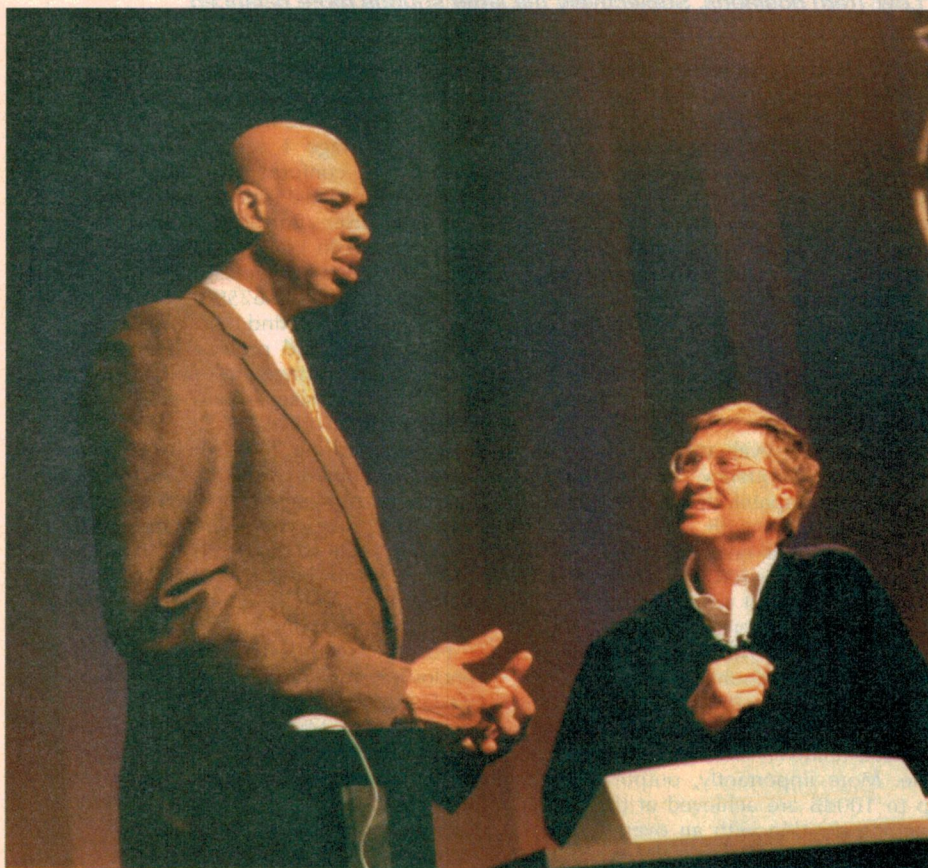
RRP: \$299 (including subwoofer)

Available: Yamaha Music Australia, 17-33 Market Street, South Melbourne 3205.

COMDEX '97: THE DVD WAR HEATS UP

Our US correspondent Paul Swart says that there were some 10,000 new products launched or demonstrated at Comdex '97, held late last year in Las Vegas. In this report he discusses some of the more interesting products and trends — including the release of two *more* competing systems for recordable DVDs (Digital Video/versatile Discs). It looks like these products are indeed shaping up for a messy Beta/VHS type marketing battle...

by PAUL SWART



As part of his keynote presentation Bill Gates showed LA Basketball star Kareem-Abdul Jabbar how to navigate a Web site.

All of the major consumer electronics vendors came to Comdex with prototypes of recordable DVD systems for home entertainment or PC application. The machines will let users record both audio and video, such as games, multimedia software, and even movies from the Internet — although interfaces to record content broadcast over TV circuits won't be available until 1999.

But it seems that this technology, one of the most promising innovations in consumer and computing markets since the development of the VCR and CD-ROM drive, is headed for an ugly battle between at least

three rival camps. It's a situation that is likely to keep consumer and business users from seriously committing to the new technology for the foreseeable future.

A total of three groups have now proposed different standards for the discs and their recorders. Two versions were introduced at Comdex, one by Pioneer (DVD-R) and another (DVD+RW) by an alliance of six companies: Philips, Mitsubishi, Ricoh, Yamaha, Sony and Hewlett-Packard.

DVD+RW is supposedly simpler and more durable than the DVD-RAM solution advocated by a coalition headed by Toshiba,

Panasonic and Hitachi. DVD+RW systems let users insert a recordable disc into the computer drive the same way they would insert a CD-ROM. Philips' DVD+RW media features an initial storage capacity of 3.0GB (gigabytes).

Developed during late 1997 at Philips' Optical Disc Technology Centre in Eindhoven, the new DVD+RW discs have the 'look and feel' of regular 120mm CDs and DVD-ROM discs. Under the DVD+ReWritable format, only minimal features are added to the existing DVD-ROM specification to permit random rewritability and allow DVD-ROM drives to read DVD+ReWritable discs at virtually no additional cost. The new discs have a track pitch of 0.8mm, a user data rate of 7 - 17Mb/s and allow more than 100,000 direct overwrite (DOW) cycles.

Taking advantage of DVD-RAM's head start over DVD+RW, Panasonic announced at Comdex that it hopes to start shipping the industry's first DVD recorder in January for about US\$800.

"With DVD-RAM, rewritability is now available to the many users who want to use DVD for writing and storing data, including MPEG-2 video and Dolby digital surround sound AC-3 audio", said Maciek Brzeski, director of Toshiba's Optical Business Unit in Irvine California. "DVD-RAM will be the most widely used rewritable storage medium since the standard floppy disk. It offers capacity, reliability, functionality, backward compatibility, removability and performance that is unmatched by any other rewritable storage format."

Industry analysts were less optimistic, in view of the new 'Beta vs VHS'-like market battle that is shaping up. "The industry can't support three rewriteable formats", said John Freeman, president of Strategic Marketing Decisions, a Silicon Valley-based consulting firm.

Toshiba said it is planning to ship several DVD-RAM systems in the first quarter of 1998. The machines feature 2.6GB of data

storage on each of two sides, for a combined 5.2GB of data.

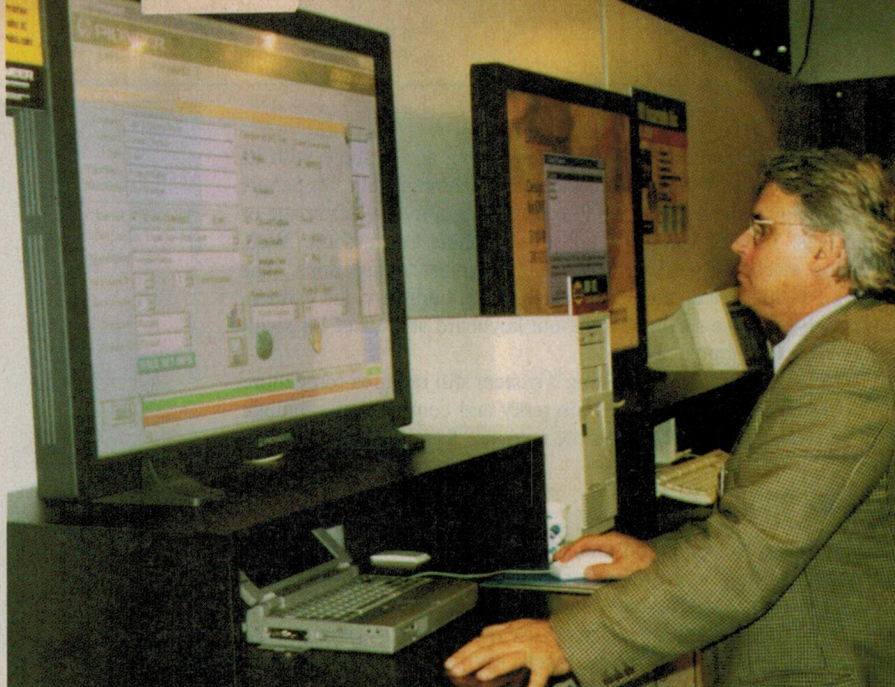
As if two competing DVD solutions weren't enough to send consumers scrambling for cover, Pioneer Electronics introduced its own recordable DVD solution called DVD-Rewritable, which was slated for release in December. It's initially aimed at professionals who need to record vast amounts of video, audio and data. Pioneer said the advantage of DVD-R is that DVD discs produced with DVD-R can be played back on any DVD format drives — including DVD-RAM and DVD-RW.

Pioneer launched the DVD-R-S101, offering 4GB of write-once recordable media based on the company's new DVD-R format. The machine features a data transfer rate of 1.39Mb/s and will be initially priced at US\$17,000.

Analysts say the fight between DVD-RAM and DVD+RW camps could become nasty because each format has distinct advantages and problems. DVD-RAM, for example, is said to be very susceptible to disk damage when the disk is dropped or even touched with fingerprints, which can hinder the ability to record information. "There's tremendous potential for confusion", said Richard Doherty, head of The Envisioneering Group, a New York consulting firm. "We're back in the 1970s."

Windows CE, Mk2

Microsoft's Windows CE for handheld computing devices has been disappointing in the market, with fewer than 200,000 units sold since the product was launched with much fanfare at Comdex '96. This time Microsoft did its utmost to once again steal the show with CE 2.0,



Numerous large flat-panel displays like these 42" models from Samsung were seen all around the show, demonstrating software.

Microsoft senior vice president Craig Mundie.

One example of just how slow the acceptance is going, Mundie said the company has signed up just 10 manufacturers licensed to build handheld computers using Windows CE. But the future appears bright now, Mundie promised. "We expect to see Windows CE applied in hundreds of millions of devices over time."

Rather than the software itself, industry analysts said CE's problem is rooted in the product concept behind it. Most people who could be considered in the market for a CE-type device already rely on their laptop, sporting all of the bells and whistles anyone could want. Those users have little use for CE devices that sacrifice readability and functionality for a little longer battery life.

New Web gadgets

There were plenty of new communications devices shown and introduced at Comdex, including new home and mobile telephones, television sets, pagers, laptops, PDAs and even units for the family car. The idea seems to be to ensure users will never be far from their favorite Web site, and always be able to review faxes and read or listen to e-mail messages.

Half a dozen firms showed products that let users add voice attachments to their e-mail. Softlink of San Francisco launched 'Voice', which retails for just US\$9.95 including the microphone and software that works with just about any e-mail program. The software compresses a voice attachment at a 50:1 ratio and sends along a player applet that lets the receiver hear the voice annotation.

A similar product called VoiceE-mail from Wizzard Software offers an 'all in one' voice e-mail application. The \$50 product comes with a microphone and headset in addition to the e-mail software.

On a more elaborate level two companies, Zap and CVideo-Mail, launched products in the US\$200-250 range that let users attach video clips (up to 30 seconds) to an e-mail message. The products come complete with camera and interface board.

Making telephone calls via the Internet also continues to be a hot subject, with products popping up everywhere with claims of being able to turn the AT&Ts of the world into the next generation of dinosaurs...

One gadget called VoiceNet from Information Highway in Port Washington (New York) lets users hook up an ordinary telephone, including wireless phones, to their PC through the VoiceNet converter box instead of using less familiar microphones and PC speakers to



The new Versapad lets users enter data using either a finger or a regular pen.

which has a number of key enhancements — including allowing for colour on the screen, enabling the sending of attachments with e-mail and printing capabilities.

Microsoft officials and companies such as Philips and Hewlett-Packard who have invested heavily in CE handheld devices, tried hard to ignore the initial failure of the product with relatively meaningless statements such as "Windows CE is gaining acceptance in the mobile computing market with manufacturers and consumers," according to

make Internet calls.

Meanwhile, Samsung Electronics scored big at the show with its Web Video Phone, which looks like a home telephone but lets people make calls over the Internet while transmitting a live video image of themselves. Callers can also use the machine to surf the Web, exchange electronic mail and conduct financial transactions. The under-US\$1000 device combines a telephone, built-in video camera, 5.6" touch-sensitive screen, a slide-out keyboard and a slot for swiping your bank or credit card.

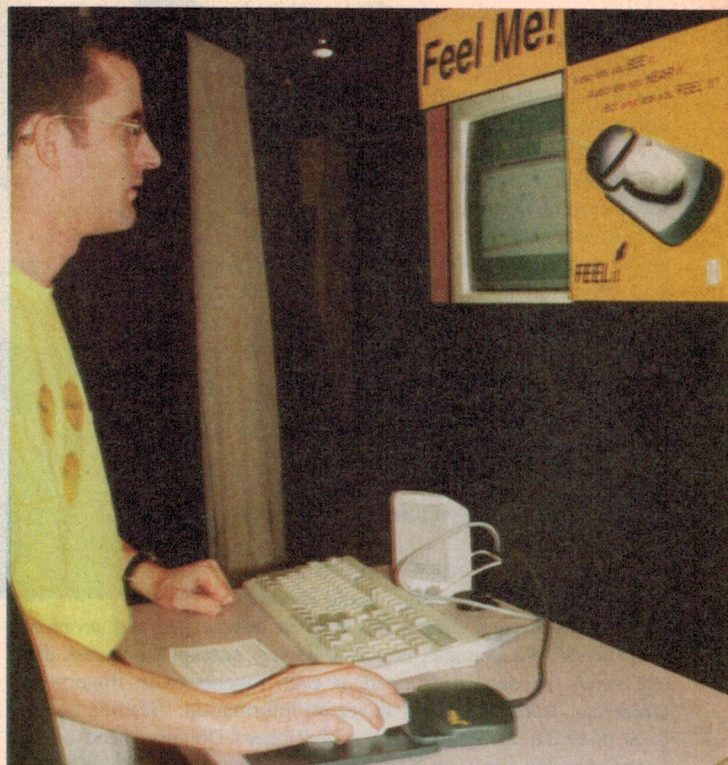
From demonstrations, Samsung's system still requires some more development. Video images remain jerky and conversations include brief pauses before you can hear the response from the person on the other end of the line.

Mobile browsing

IBM, Delco, Netscape and Sun Microsystems showed off a prototype of a car they jointly developed which incorporates the latest speech recognition technology and built-in screens that enable passengers to cruise the Internet. Drivers use their voice to command the on-board computer. It even talks back; say "Read stocks" and the computer lists stock quotations out loud.

The car receives its Internet content via a satellite-based communications network. The problem is that to work properly, the system's antenna must be pointed in the direction of the communications satellite. It will be several years before such antenna can be developed economically, said Richard Lind, director of automotive electronics development for Delco Electronics Corp.

Perhaps the Delco engineers should be talking to AirMedia, which showed off the company's new mobile Web access antenna. AirMedia provides Web data broadcasting services throughout the



San Jose firm Immersion demonstrated its Feel-It mouse, which provides programmable tactile/force feedback to the user.

Keynote addresses: from silly to bewildering...

Presentations by Comdex 97's keynote speakers Bill Gates, Compaq's Eckhard Pfeiffer and Cisco Systems' John Chambers covered a wide range, from somewhat embarrassing humour to mind-blowing predictions.

True to form, Bill Gates gave the 7000+ people who packed the Aladdin Auditorium for Sunday evening's keynote Comdex address something to tell their grandchildren about, as the Microsoft chief turned standup comedian. The act seemed to be a carefully orchestrated effort at making Gates and Microsoft appear somewhat less monopolistic and more everyday-guyish, to a world that appears increasing bent on preventing the US\$40 billion software magnate from stuffing the entire digital revolution in his back pocket.

Gates spent much of his 90-minute "Why I love my PC" address poking fun at himself, along with some gentle pokes at the legal problems Microsoft is having in Washington DC and elsewhere. His lighthearted presentation received mixed reviews among industry observers. Many agreed it was a welcome change from the defiant 'in your face' attitude Microsoft has been displaying in battling the Department of Justice and Sun Microsystems. Others said that it may indicate Microsoft is starting to realise the trouble it is in. All agreed it will take a lot more than a few funny jokes for Gates to change the rapidly increasing negative public perception of him and his company.

Gates illustrated his presentation with several guests, including LA basketball great Kareem Abdul Jabbar, who at 7-foot-2 inches towered over the 5-10 Microsoft founder during a demo of his new Web site. The biggest laugh of the

evening came when Gates had to reach up to the height-adjusted mouse pad to help Jabbar navigate around the site.

Another guest, US Marine Corps Major Jim Cumiskey, showed how the Marines are building 'Marine-proof' notebook computers with off-the-shelf components. To demonstrate, he threw his laptop on the stage floor and jumped on it, after which it booted up just fine. Cumiskey also demonstrated a test version of how a GPS-enabled handheld computer running Windows CE is being used to help Marines keep track of their positions on the battlefield — and those of their enemies.

Compaq CEO Eckhard Pfeiffer's prediction that the top four PC vendors will control 70% of the market in five years drew gasps from the crowd of 4000 at the Aladdin Hotel Casino. Today, the top four PC vendors control 34.7% of the market, already up sharply from 24.1% a year ago. In his soft-spoken, analytical style, Pfeiffer detailed how only the largest suppliers will be able to offer customers a 'total value proposition' that includes anytime/anywhere access to service, lowest cost of ownership, and long-term close relationships between vendor and customer.

Other companies that will be among the top vendors include IBM, HP, Fujitsu and NEC. Pfeiffer said Compaq will also be one of the top three computer makers in the world in 2000, when he expects the company's revenues to exceed US\$50 billion, double predicted 1997 sales of \$25 billion.

"The PC is the most powerful, broadly used instrument in history. The PC is leading the information access revolution. Along the way,

the PC will reach into the most complex, mission critical applications and displace legacy systems", Pfeiffer predicted.

Perhaps even bolder than Pfeiffer's prediction of massive consolidation at the top of the PC hardware industry was the forecast issued by Cisco Systems CEO John Chambers, who said that recent estimates that electronic commerce will generate between US\$20 billion and \$300 billion in sales by 2000 are way off, and that the actual volume of products and services purchased over the Internet may be closer to US\$1.5 trillion by 2001.

"Network commerce will grow faster than people realize" Chambers said, in a keynote address that compared today's evolving Internet Revolution to the Industrial Revolution.

Chambers said that most of the growth in electronic commerce will be fueled by business-to-business transactions. Currently 39% of orders for Cisco's products, such as networking equipment, are placed by customers over the Internet.

He expects the huge demand for networking products will lift Cisco's sales to a two or three-fold increase in the next three years. "By the year 2000, we could be in the range of US\$15 billion to \$20 billion", Chambers said. In fiscal 1997, Cisco's revenues were \$6.5 billion.

The company's business in Asia, which represents about 12% of revenues, has slowed down severely in recent months due to the currency and other economic instabilities being experienced in the region. While the Asian markets represent a challenge to Cisco, China is still a booming market and the United States still represents its fastest growing market. "We don't see the US slowing down and we are seeing many countries in Europe starting to pick up capital spending."

United States to subscribers who buy the antenna, which hooks up to a laptop or other portable computer device. Several dozen major news, financial, sports, entertainment and other media services are available to Air Media subscribers.

The new mobile antenna measures about the size of a pager and can be worn on a belt, with a wire connection to the laptop or other device.

The latest advance from Microsoft's Web TV subsidiary allows viewers to simultaneously see their favorite TV show and a Web site in different windows on the TV screen. Web TV hopes content providers will use the capability to develop interactive programs, such as games that integrate Web content with TV programming and feedback capability.

WebTV is desperate for a killer application that will lure people to start buying the devices. Forrester Research estimates that sales of Web TV and similar devices won't reach one million until the year 2000. But the research firm also predicts that by 2002, improvements by manufacturers will convince 14.7 million households to connect their TVs to the Internet, and 9.2 million to have Internet-connected screen phones.

True Internet phone

Aplio showed a new Internet phone that doesn't need a computer to make toll-free long distance calls over the Internet. That's because all of the necessary hardware and Web access software is built right into the device. The US\$200 Aplio looks like a regular telephone, plugs into any telephone wall socket and dials the Internet address of the recipient. After connecting, the two parties can talk as long as they want — no matter where they are located on the planet.

Scheduled to hit the market in January, the Aplio incorporates a high-speed modem and the circuitry and silicon-based software to connect to the Internet. Analysts said the Aplio and the many similar devices that will enable consumers to make telephone calls over the Internet will put new pressure on long distance telephone companies.

Family MCs

Ready for a new buzzword and acronym? One new kind of device introduced at Comdex is called a 'Media Centre' (MC) — a new generation of family-friendly machines that will hit the market in late 1998 and are aimed at the family room.

MCs let consumers watch TV, surf the Internet and send/receive e-mail, play audio CDs, DVD movies and CD-ROM computer games. And of course they enable users to run thousands of Windows software applications. Best of all, they'll cost less than US\$1000 when they hit the market in mid-to-late 1998.

Media centre prototypes that integrate television and other home entertainment components with the PC and Internet were

shown by Cyrix and Cirrus Logic. The two chip firms showed MC prototypes with an impressive amount of horsepower under the hood for a sub-\$1000 machine. Both were built around 200MHz MMX processors and came with 32MB of RAM, a 2GB hard drive and a DVD-ROM that plays both DVD movie, computer CD-ROM and audio CDs. The machines also include a TV tuner that lets the device display simultaneous television and Web pages or other computer applications, in different windows that can be expanded to full screen at the click of the mouse. Both the Cyrix and Cirrus Logic MCs are designed to run Microsoft's Windows 98, which will offer a number of entertainment-oriented features.

Cyrix, which coined the term media centre, said MCs will be packaged and sold by their manufacturers as home entertainment systems rather than a PC work tool. "The term PC can turn off a lot of people, who can't see a PC next to their TV", said Paul Pascarelli marketing manager at Cyrix — which was bought by National Semiconductor weeks before the show.

NCs disappoint again

If network computers (NCs) are ever going to be a big item, it wasn't evident at Comdex '97.

So far, in nearly three years, fewer than



Major Jim Cumminskey with a GPS-enabled handheld computer used to help the US Marines keep track of their positions.



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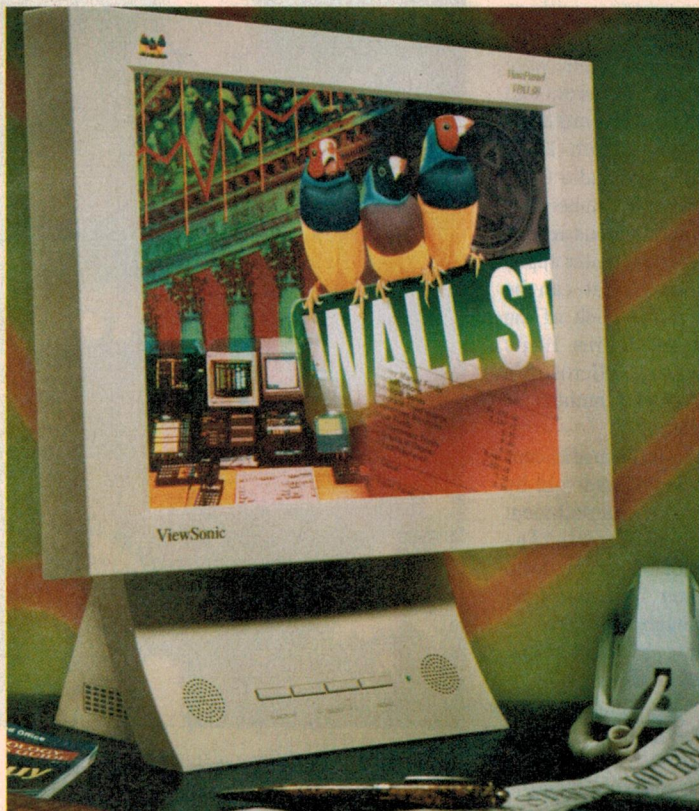
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Viewsonic showed this neat flat-panel display, complete with multimedia speakers built into the base.

200,000 NCs have been sold despite all the hype and hoopla. That's why many Comdex visitors were all the more surprised to find an NC on display in the booth of the company that has ridiculed the idea of network computers like no other: Microsoft. The company showed its Windows based NC, which it carefully refers to as a 'Windows terminal' rather than a network computer.

"Windows-based NCs could really turn this network computer battle on end", said Sean Kaldor, an analyst for International Data Corp in Silicon Valley.

Microsoft said it has signed up five manufacturers to produce Windows terminals, including Boundless Technologies in New York, NCD in Mountain View, Neoware Systems, Tektronix and Wyse Technology, an Acer subsidiary. The systems will retail for US\$600 to \$800, including keyboard and monitor. Microsoft expects the price to fall to around \$600 shortly after the machines enter the market in volume.

Originally, NCs were envisioned by Oracle's Larry Ellison to run mostly on the Java operating system. But that proposition has produced virtually no takers. Sun Microsystems, for example, pulled out of Comdex after it failed to

sign up enough companies to display Java-based NCs in the booth it had planned for the show.

The only Java NCs were available from IBM and Canada's Corel Computer. Both will cost around US\$1000 without monitor. Analysts said that at that price, most buyers will opt for a full-blown PC, many of which are becoming available at around \$1000 or below.

New Web browser

Who, in the midst of the fierce browser battle between Microsoft and Netscape, would think of launching a new browser? Bigfoot Partners, that's who. With a move that rivals the strangeness of the company's name, the New York company launched its NeoPlanet browser — which is available free for download at www.neoplanet.com.

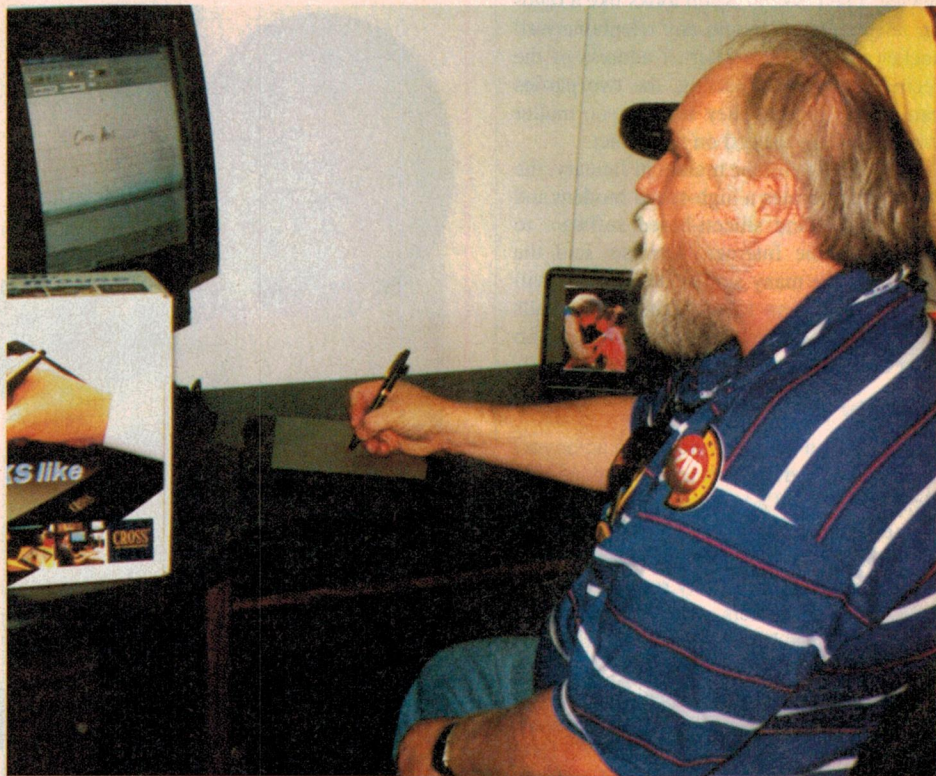
According to Bigfoot's president Jim Hoffman, the NeoPlanet browser was created for the "millions of consumers that shy away from the Internet for its seeming complexity. A lot of people are drawn to America Online and similar services because they organize their content in clear and simple channels. With NeoPlanet, we've done that for the entire World Wide Web."

NeoPlanet can be downloaded in just two minutes with a 28.8K modem, but for now only works with Windows 95 and NT.

Flat panel displays

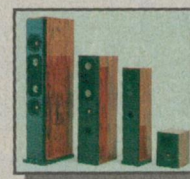
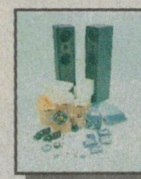
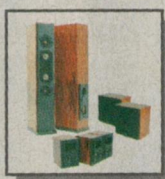
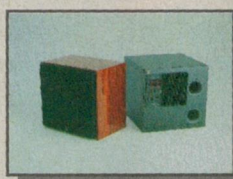
Flat panel displays could be found all over the show, and in all sizes from 10" to 42" diagonal. They're still in the US\$2000 to \$10,000 range, but most exhibitors said they expect prices to come down dramatically starting in 1998 and 1999 — when volume production of large-size flat panel displays is scheduled to come on line at a number of key producers.

In the meantime, large flat panel LCD displays can be expected to find their way into many corporate conference and product demo rooms, where they will impress customers with crisp images. ♦



Pen and pencil makers AT Cross showed the CrossPad, for easy input of drawings and handwritten notes — via advanced handwriting recognition software from IBM.

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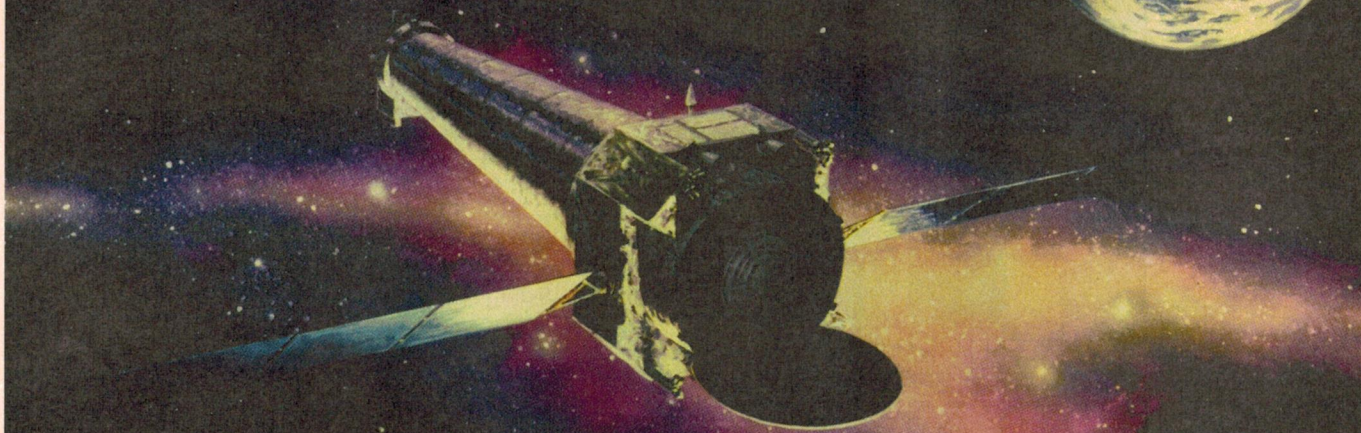
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SCANNING THE X-RAY UNIVERSE



Later this year, NASA plans to launch the third of its major orbiting telescopes — AXAF, the Advanced X-Ray Astrophysics Facility. Designed to provide high resolution images of the Universe at X-ray wavelengths, along with detailed spectral analysis, the new telescope is likely to have at least as much impact on astronomy as its forerunners the Hubble Space Telescope and Compton Gamma-Ray Observatory.

by GEOFF McNAMARA

If all goes according to plan, in August this year a NASA space shuttle will release a 12-metre long metallic cylinder into low Earth orbit. The spacecraft will be coupled to a booster which will fire shortly after leaving the space shuttle and take it into the first stages of its final elliptical orbit. Once there, the spacecraft will unfurl its solar panels like a fledgling bird spreading its wings for the first time. A sunshade door will open the spacecraft's eyes onto the Universe, allowing a camera to locate reference stars for pointing as other sensors locate the Sun and Earth.

The glittering cylinder will then begin gathering images of some of the most violent and powerful phenomena known. This is AXAF, the Advanced X-ray Astrophysics Facility, and it has been built to study the X-ray universe.

AXAF is the latest in NASA's series of 'Great Observatories', major orbiting astronomical telescopes designed to help answer the fundamental questions about the universe. AXAF will join the well-known Hubble Space Telescope and the lesser-known Compton Gamma

Ray Observatory, both of which have been making invaluable contributions to our knowledge of the visible and the gamma ray sky.

X-ray astronomy deals with the high energy universe. High energy astrophysics, as this field is called, examines the universe at wavelengths shorter than about a half a nanometre — but longer than gamma rays. Its name derives from the fact that the short wavelength X-radiation it uses to study the Universe carries more energy than longer wavelengths, and is produced by correspondingly high-energy events.

The era of X-ray astronomy began 35 years ago when Massachusetts Institute of Technology physics professor Bruno Rossi persuaded the American Science and Engineering Corporation (of which he was chairman) to begin the development of instruments for examining the X-rays emitted by the Sun, Moon and certain cosmic sources such as supernova remnants. After being turned down by NASA, the US Air Force supported an attempt to study X-ray fluorescence from the Moon using Rossi's instruments.

The scientists knew that the Sun was an X-ray source. But when the first X-ray satellite was flown in 1962, they were startled to find that the glare from the X-ray sky totally eclipsed the Moon. They had expected cosmic X-ray sources; what they hadn't counted on was the *intensity* of these sources. Some individual sources were pouring out 100,000 times the energy of the Sun. Clearly, this was going to be a whole new era of astronomy.

Since X-rays are (thankfully) incapable of penetrating Earth's atmosphere, this new area of astronomy was eminently suited to the emerging space age. On 12 December, 1970 an American satellite called Uhuru (Swahili for 'freedom') was launched from Kenya to help celebrate that country's independence. Uhuru provided data that allowed the creation of a catalogue of 339 X-ray sources.

The two decades that followed saw a flotilla of X-ray satellites, including the three High Energy Astrophysical Observatory spacecraft (HEAO 3 was, in fact, a gamma ray observatory), and

the German ROSAT (Rontgenstrahlen Satellite). HEAO 2 was subsequently renamed the Einstein Observatory, in celebration of the centenary of the great scientist's birth.

Chequered history

Following the spectacular success of the Einstein Observatory and ROSAT, astrophysicists were keen to take the next step of producing a major astronomical observatory for the study of X-rays. NASA had intended to follow the Hubble Space Telescope with AXAF. The X-ray satellite would also be the successor to the successful Einstein Observatory. But like so many spacecraft, AXAF was to have a chequered history.

First proposed in 1976, AXAF was to be a considerably more elaborate telescope than is now nearing completion. Owing to budget cuts in 1992, the mission was divided into two smaller missions — AXAF I (for X-ray imaging) and AXAF S (for X-ray spectroscopy). Since then, AXAF S has been dropped altogether, and now AXAF-I is the only spacecraft intended for orbit.

AXAF is a major improvement over earlier X-ray telescopes, but it owes its improvements to the spectacular success of those earlier missions. Another spacecraft which carried an X-ray telescope was the American space station Skylab. In fact it carried two, one for high energy X-rays in the 0.3 - 0.6nm range, and a second for low energy X-rays in the 0.6 - 3.3nm range. Skylab's telescopes introduced a major development in X-ray astronomy by employing 'grazing incidence' X-ray mirrors.

Until Skylab, X-ray satellites like Uhuru used detectors called 'proportional counters'. These instruments consisted of a gas-filled tube with a pair of electrodes at each end. Whenever an X-ray passed through the tube, it would ionise the radiation and encourage the flow of electrons to the positive electrode. The size of the pulse was proportional to the number of electron-ion pairs, which was an indication of the energy of the incoming radiation. These X-ray detectors were sensitive and provided much information on the intensity and location of the sky's X-ray sources, as well as some spectroscopic information.

Beginning with Skylab, however, grazing incidence telescopes have provided a means of creating *images* of the X-ray sky. Because of the high energies of X-rays, using an ordinary mirror wouldn't work: the X-ray photons would simply fly on through. In order to reflect X-ray photons, the mirrors used

are set at an extremely high angle so that the photons skim off the mirror surface like a stone skipping across the surface of a pond.

This technology has been carried one step further with AXAF. In fact, AXAF's grazing incidence mirrors are said to be the smoothest telescope mirror surfaces ever produced. They need to be, for AXAF's mission is to produce the most detailed picture of the X-ray sky ever.

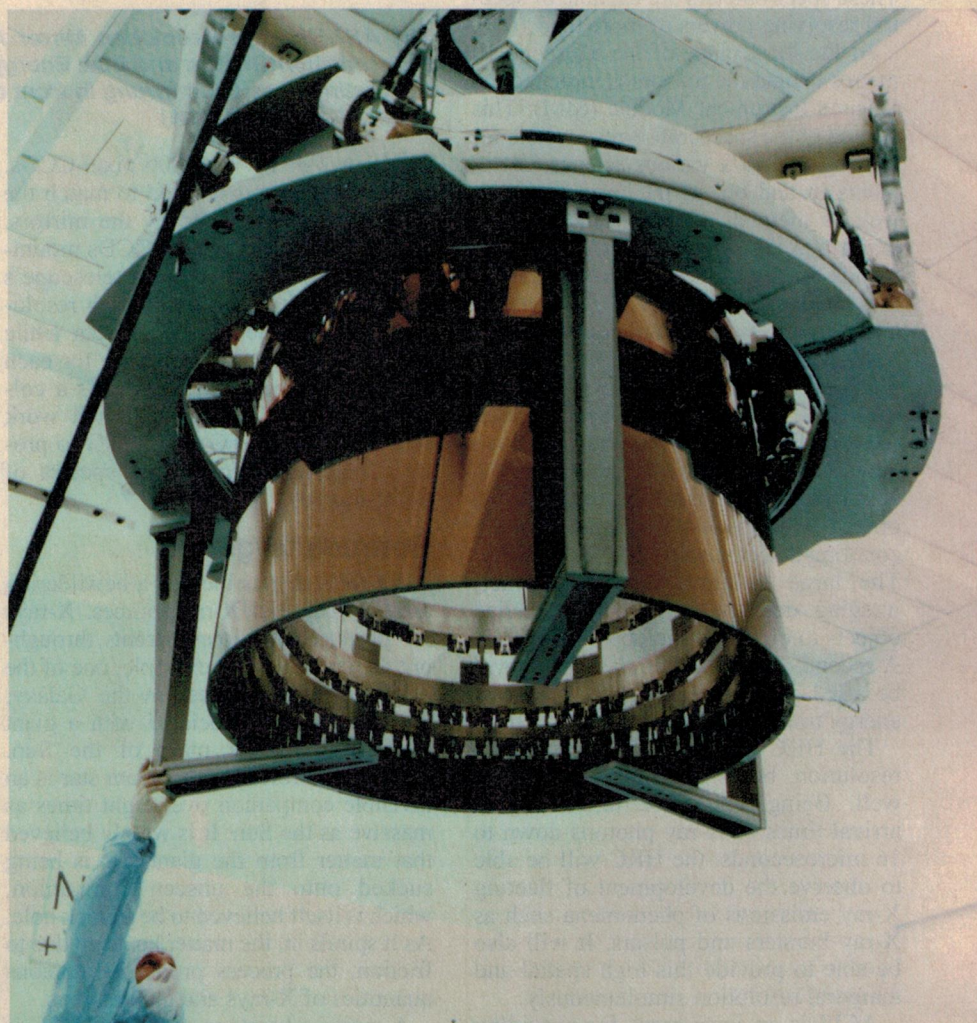
'Picture' is meant literally: unlike its predecessors, AXAF will do more than simply build up data on the location and intensity of X-ray sources. AXAF will produce images of the X-ray sky, with a resolution of an incredible 0.5 arc-second, fully 10 times finer than ROSAT. This is the equivalent of reading a newspaper a kilometre away. Such keen vision coupled with the most sensitive X-ray detectors ever flown will produce images of the X-ray sky comparable with the visible light images returned by the Hubble Space Telescope.

Four mirror pairs

AXAF's grazing incidence telescope consists of four pairs of 'nested' mirrors (the original proposal had six pairs). Each pair consists of one paraboloidal mirror sitting in front of one hyperboloidal mirror. Fitting one inside the other, the pairs of 80cm long mirrors are more like bottomless drinking glasses. The diameters of the mirrors range from 0.6 to 1.2 metres. Each mirror has been ground to a surface accuracy of a few atoms, exceeding specifications, and coated with iridium to increase their X-ray reflectivity. The smoothest and cleanest mirrors ever made, the AXAF mirrors represent an historic technical accomplishment.

The 2.7-metre long mirror assembly has since been aligned to an accuracy of 1.3µm. The telescope mirrors will focus 70% of incoming X-rays to an area barely a half-arc second in radius.

To produce X-ray spectra of objects under observation, AXAF includes two



The AXAF High Resolution Mirror Assembly. (Courtesy NASA)

Scanning The X-Ray Universe

transmission gratings for high and low-energy X-rays. Both the High Energy Transmission Grating (HETG) and the Low energy Transmission Grating (LETG) are mounted just behind the mirror assembly, so they can be swung into the telescope's optical path to disperse the X-ray radiation source in the field of view into its spectrum. The transmission gratings will produce high resolution X-ray spectra which will be imaged by one of the two science instruments mounted at the rear of the spacecraft.

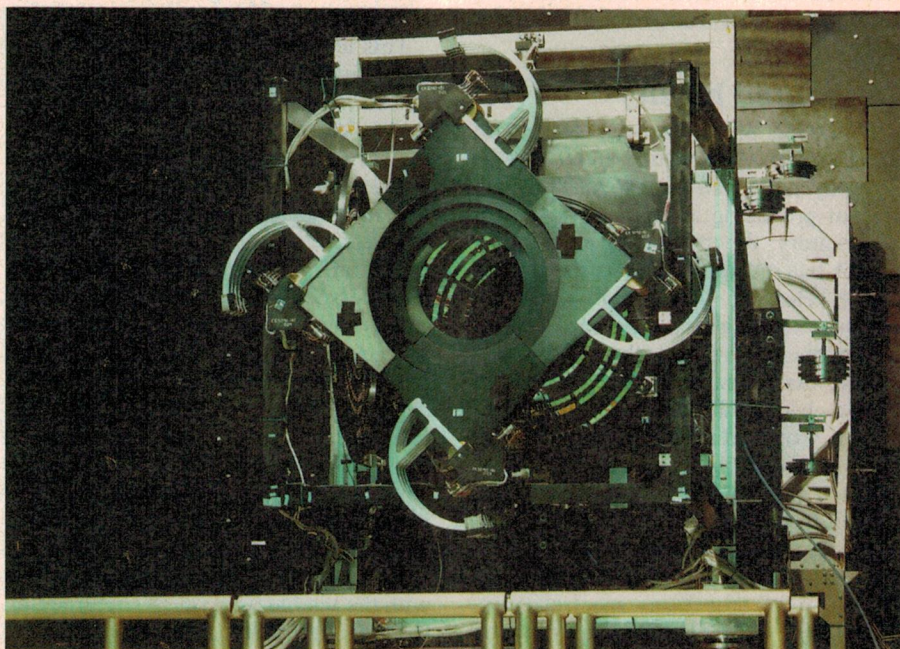
The HETG consists of 336 individual grating elements, each about 25mm square, made of plated gold bars supported by a thin polyimide film, and mounted onto a machined aluminium torus. Two types of grating elements are used which are optimised for a different range of X-ray energies. The LETG covers a wavelength range of about 0.5 - 14nm (0.08 - 2keV). It has 540 grating elements. These spectrometers are capable of spectral resolving powers of more than 1000.

At the focal plane of the telescope 10 metres behind the mirrors is mounted the Science Instrument Module (SIM). This section of the spacecraft is responsible for moving AXAF's various science instruments in and out of the focal plane, as well as thermal, communications, command and data management. The commands for the spacecraft are transmitted as a preplanned sequence of observations and stored in the on-board computer.

AXAF has two science instruments: the High Resolution Camera (HRC) and the AXAF CCD Imaging Spectrometer (ACIS). The HRC will provide the much anticipated high-resolution images of the X-ray sky. It has two sets of detectors, one of which is a 10cm square photon counting detector optimised for imaging. The large format (16 million pixel) imaging detector will allow extended objects to be imaged in one observation. A second, 20mm x 300mm detector will be used in conjunction with the low energy transmission grating.

The HRC has not only high spatial resolution, but high time resolution as well. Being able to differentiate the arrival times of X-ray photons down to 16 microseconds, the HRC will be able to observe the development of fleeting X-ray emissions of phenomena such as X-ray bursters and pulsars. It will also be able to provide this high spatial and temporal resolution simultaneously.

ACIS is an instrument for providing simultaneous imaging and spectroscopy. The instrument consists of



The AXAF's High Resolution Mirror Assembly (HRMA) with the High Energy Transmission Grating and Low Energy Transmission Grating attached. One of the gratings has been swung in front of the HRMA, while the other can be seen at left. (Courtesy NASA)

two arrays of 1000 x 1000 pixel CCDs. Each of the arrays is tilted to match the focal surface produced by the mirrors. The imaging array is four CCDs mounted as close as possible to the telescope's focal plane. It will provide high resolution images of extended objects while providing spectral information for each pixel. The spectroscopy array is a collection of six CCDs which will work with both the HETG and LETG to produce high-resolution X-ray spectra of point sources.

Sources targeted

AXAF's targets include a bewildering array of celestial X-ray sources. X-rays are produced in violent events throughout the universe. For example, one of the brightest X-ray sources in the Galaxy, Cygnus X-1, is associated with a giant star 20 times the mass of the Sun. Sharing an orbit with this giant star is an invisible companion over eight times as massive as the Sun. It is widely believed that matter from the giant star is being sucked onto the unseen companion, which is itself believed to be a black hole. As it spirals in, the matter heats up due to friction, the process producing copious quantities of X-rays and gamma rays.

A major advantage of X-rays is their ability to penetrate dust, which is plentiful in the Galaxy. Not only will AXAF

allow observation of hidden treasures deep within the centre of the Milky Way, it will also allow astronomers to study objects in spiral arms on the far side of the Galaxy.

Other sources of X-rays include similar phenomena occurring on galactic scales, where the masses of hundreds of stars spiral down into super-massive black holes at the hearts of active galaxies. In both cases — stellar and galactic X-ray sources — the observed energies and variability of the X-ray emission are evidence for the existence of black holes.

AXAF will target these and other phenomena when it is launched in August this year. Orbiting the Earth in a highly eccentric orbit that carries it a third of the way to the Moon, AXAF will spend 85% of its orbit above the van Allen radiation belts, permitting uninterrupted observations up to 55 hours long.

If the Hubble Space Telescope's success is anything to go by, AXAF will revolutionise X-ray astronomy. Certainly its design — and the fact that construction has so far exceeded specifications and come in ahead of schedule — promise a bright future for high energy astrophysics and our knowledge of the high energy universe.

(Geoff McNamara is a freelance science writer based in Sydney, and a frequent contributor to EA.) ♦

A-V PROCESSOR/MIXER FOR VIDEO EDITING

Made in the UK, the VEC1030 combines a flexible video enhancer and fader with a three-channel stereo audio mixer. Compact and easy to drive, it provides many of the basic facilities needed for editing and enhancing videos — at low cost.

by JIM ROWE

Whether you're editing your video material manually using the pause controls of your camcorder and VCR, or automatically using a fancy edit controller, there's often a need for a bit of picture enhancement or adjustment. Perhaps the original scene is a bit dark or light; or the colour too pale or too garish; or you just want to give the picture detail a bit of a 'tweak' to allow for the inevitable losses of dubbing...

If you're doing manual editing, it's also nice to be able to fade or wipe out of one scene or into another, as a change from the usual cut.

On the audio side, there's often a need to be able to mix in some background music from a CD or cassette tape, or remove an unwanted off-camera sound effect from an otherwise good scene.

The VEC1030 Video Processor/Audio Mixer from UK maker Video Tech Designs is designed to provide all of these facilities, in a compact and relatively inexpensive form. The controls are also laid out and used in a fairly intuitive way, making it relatively easy to drive even for those without much technical background.

On the video side, the VEC1030 has a single composite video input and output, and combines an image enhancer with a fader/wipe facility. The enhancer has three basic controls: a Detail control to allow boost/cut of picture details (+/-6dB at 1.5MHz), a Brightness control to boost black level (0 - +100mV) and a Colour control to either reduce or boost the chroma level (roughly 2% — 200%). All three enhancement controls can be removed from circuit if not needed using a Bypass switch, to ensure minimal picture degradation.

The fader/wipe part of the video processor gives you the option of fading or horizontally wiping to (or from) black, white or any desired shade of gray — as set using the Shade control. A nice bonus of the Wipe control is that it can also be used as a 'picture split' control, for checking the action of the enhancement controls (during setup, not during actual dubbing). When the enhancement controls are in circuit and the Wipe control is set to about half-way,



you can view the 'after processing' image on the left-hand side of the image and the 'before' image on the right. This makes it very easy to see what you're doing.

All of the above video controls are of the rotary type except for the Fade control, which is a slider (60mm travel). RCA sockets are used for video input and output. The audio side of the VEC1030 is fairly basic, but likely to be more than sufficient for most people. There are three stereo input channels, each with its own slider control. All three input channels accept line-level signals via twin RCA sockets, but channel 3 is also provided with a 6.3mm mono jack and internal microphone preamp, suitable for any low impedance mic.

There are three RCA sockets for the audio outputs — two delivering the L and R stereo outputs, and the third a mono output.

The VEC1030 is also pretty flexible when it comes to power supplies. It runs from 9-15V DC, fed in via a standard 2.5mm DC connector, and draws about 80mA. It comes with a mains plug pack, but could obviously be run from a battery pack if needed for a 'shoot'.

Trying it out

I tried out the sample VEC1030 with composite video from a VCR, using both tapes and off-air signals. It turned out to be very intuitive to drive, and there was really no need to refer to the user manual.

The video enhancement controls were

very smooth in operation, and had no observable effect on image stability. I particularly liked the way the Wipe control allows you to compare the 'before' and 'after' images on each side of the screen; this makes it very easy to optimise any enhancement. It's also good to be able to set the fade/wipe reference level to black, white or any shade of gray in between.

The slider pots used for the video and audio faders are very smooth in operation, too.

In short, then, I found the VEC1030 a very flexible and easy to use little unit. Considering its low price, it should be of great interest to anyone editing tapes — especially without the benefit of an edit controller or other high-end gear. ♦

VEC1030 Video Processor & Audio Mixer

Compact video enhancer and fader/wipe unit, combined with a three-channel stereo audio mixer.

Good points: 'Split-screen' facility allows easy optimisation of enhancement settings. Plenty of facilities, considering the price. All controls work smoothly.

Bad points: Nothing significant.

RRP: \$259 incl. tax

Available: Questronix, Unit 2, 1 Leonard Street, Hornsby 2077; phone (02) 9477 3596, fax (02) 9477 3681.

DISPOSALS, 90'S STYLE

Gone are the days of shops specialising in ex-military electronic disposal goods. But there are still some very exciting and useful disposal items around, as you'll read in this review.

by PETER PHILLIPS

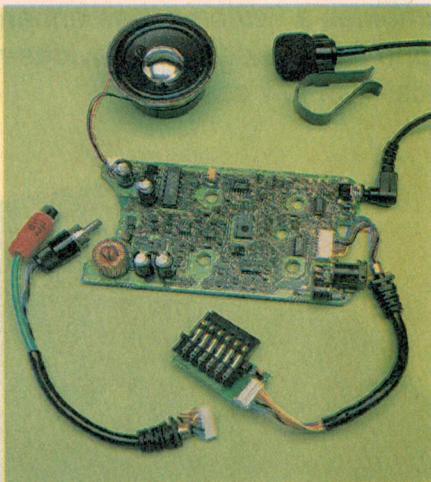
These days it's a lot more difficult to find disposal goods, not because they aren't around, but mainly because most of the old disposal stores have closed. Outlets such as Jaycar stock some disposal items, but very few places seem to now specialise in these. One such place however is Oatley Electronics, a company perhaps better known for its kits for electronic projects.

In the past, disposal goods usually came from surplus military stock, telecommunications companies like Telstra, or from manufacturers that had either gone out of business, or who wanted to get rid of stock no longer needed. This is still happening, but these days the range of disposal items has changed, and, as we found, there are now some quite amazing goods available.

We haven't space to list all the disposal items currently available from Oatley Electronics, so we'll stick here to those that appear to have been destined for use with mobile phones.

Mobile phone parts

You might not think old mobile phones can have any useful parts, if you think only of the handset. In fact, you won't



This unit is a 5W audio power amplifier with microphone preamp. The amplifier input and the preamp output are both accessible, and we made a small adaptor with RCA connectors to convert the unit to a workshop test amplifier.

even find handsets available as disposal items, at least not yet. But consider the accessories, such as the battery, the battery charger, the hands-free adaptor unit

and so on. All of these items in one form or another are now coming onto the disposals market. This is because manufacturers need to keep coming up with new models to service an expanding and demanding market. As a result, some of the items are only a few years old, yet out of date by current standards.

Here's a quick look at some of the items Oatley Electronics has on hand, at prices that seem almost ridiculous when you realise what you are getting, and the original price of the goods.

Amplifier & preamp

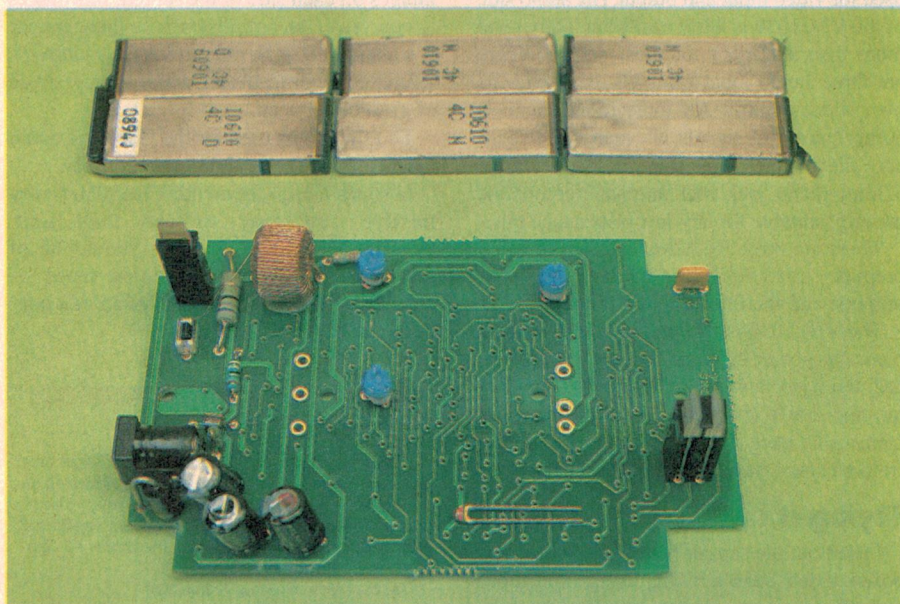
This unit is probably part of a hands-free adaptor, and as the photo shows, is a nicely built unit with surface mount components, a quality unidirectional electret microphone, a speaker and so on. You might just want it for the parts, but the unit is immediately useful as a complete 5W power amplifier and a pre-amplifier for the microphone. The input to the amplifier is 1Vp-p, and is easily accessed, as the documentation supplied by Oatley Electronics explains. Also accessible is the output from the microphone preamp, again a nominal 1Vp-p.

Using the supplied documentation and some circuit tracing, we were able to easily modify the unit by adding an RCA socket as the input to the amplifier and an RCA plug as the output from the preamp. Plug the two together and you have a complete, compact mini PA system.

Applications include connecting two of these as an intercom, as a workshop test amplifier, a tester for electret microphones, as a preamp for a microphone and so on. The units appear to be brand new, run from 12V DC, and come with the original microphone (with nearly three metres of cable), speaker, basic information and a technical data sheet on the TDA1905 power amplifier IC. The cost is \$25 for two(!), and a suitable DC plugpack is available for \$12.

7.2V NiCad charger

Although there's not much technical information available about it, this quality built charger seems to have it all. It appears to have been part of a fast, intelligent desktop battery charger, and can both fast charge and trickle charge. It



This 7.2V NiCad charger has most of the components on the reverse side of the board. It can be used with the 7.2V 380mAh battery pack shown here, and charges at around 0.8mA.

uses temperature sensing, voltage sensing and even has a timer to terminate the charge. It can also discharge a battery prior to charging.

Again Oatley Electronics supplies enough information to be able to use the charger, along with a thermistor for temperature sensing. The photo shows one side of the unit, and you might think it's incomplete. However, the other side is stocked with a large number of surface mount components, and you will quickly see that this is no ordinary charger. It has three LED indicators (some are dual LEDs) to show the status of the charge, a DC input socket and three trimpots that give some adjustment.

The unit is complete, except for its case, and is ready to use. The above-mentioned plugpack suits the charger. The cost is \$9 per unit.

7.2V NiCads

Also available are 7.2V 380mAh NiCad battery packs that can be used with the charger. These packs were possibly for use with mobile phones and comprise six rectangular, low profile NiCad cells, a temperature cutout switch, the terminals, a 15k resistor and a temperature sensing device that we couldn't identify. The batteries appear to be brand new.

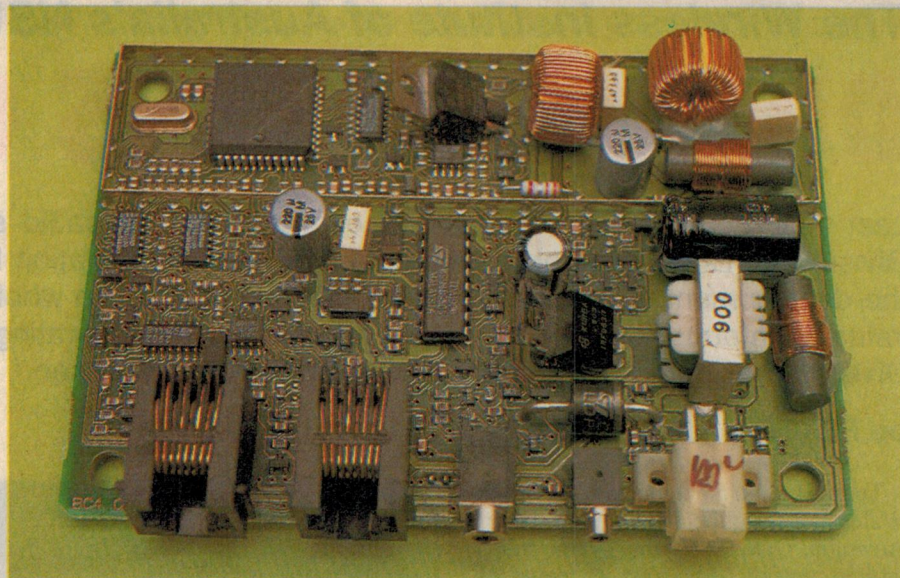
When connected as suggested in the documentation supplied with the charger, the charge current taken by a battery pack was around 0.8A. Pressing the discharge button on the charger causes a discharge current through the charger of around 100mA. The discharge is terminated when the battery voltage reaches around 7V, after which the charger resumes charging at the full rate.

We tested the charger by connecting it as described, but with the battery pack's internal temperature sensor, rather than the thermistor supplied by Oatley Electronics. It took around an hour to fully charge a pack, after which the charge current dropped to 55mA. A battery pack costs \$2 and measures 150 x 35 x 8mm (LxWxH).

Wiring loom

Originally sold as part of a car installation kit, each loom has a four-pin Utilux style connector, three metres each of 0.5mm² (csa) blue and yellow cable, and over four metres each of heavier duty red and black cable (1.5mm² csa). All cables have automotive quality insulation and are multistranded.

Also included are two automotive style 4A fuses and holders with terminating lugs, three spade connectors and a parallel cable connector. The cost is



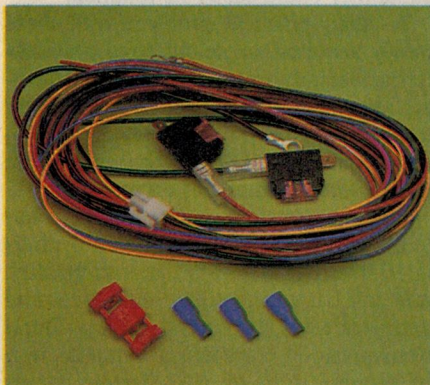
This board has a number of useful connectors and components, including two complementary power MOSFETs.

\$1.50 per loom, or five looms for \$9, giving over 70 metres of quality cable and connectors.

Mounting brackets

Again originally part of a car installation kit are two black plastic mounting brackets, complete with screws and so on. One of these was probably to support a small speaker, and has a universal swivel mount to allow the speaker to be positioned as required. This bracket is surprisingly strong, and we guess it could support a load of 5kg or more. The backplate that bolts to the load measures 48 x 44mm and has four holes for screws to secure it to the load. The bracket itself is screwed to a wall or whatever with three screws.

The other bracket is simply a backplate whose original purpose we couldn't figure out. It has the same dimen-



This shot shows the wiring loom from an installation kit. It includes two automotive fuses and holders. There's about 14 metres of automotive quality cable in the loom.

sions as the backplate of the universal mounting bracket. The cost for both units is \$1.50.

Mystery box

This unit is probably part of an automotive installation kit for a mobile phone, and is useful mainly for parts. It has two power MOSFETs, a number of phone connectors and a range of surface mount and conventional components.

The MOSFETs are an IRF9530 (P-channel, TO-220AB case, 100V, 0.3 ohm on-resistance) 12A device and an IRF530 (N-channel, 100V, 0.16 ohm on-resistance) 14A device. We think part of the circuit is a UHF power transmitter, perhaps for use with a rear window antenna. The price is \$4 for two, which is far less than you'd pay for the MOSFETs — let alone the rest of the parts.

Other bits & pieces

There are lots of other items, such as a quality car cigarette lighter lead terminated in a 2.1mm DC plug (three for \$7) and a four ohm, 3W, 500mm diameter speaker in a neat little enclosure with a swivel mount. The 1.5m speaker lead is terminated in a jack plug. The price of the speaker unit is \$6.

Also available are two types of electret microphones, one with an alligator clip for use as a lapel mic (\$4), the other with a clasp and pop filter (\$3). Both come with a 2.8m shielded lead terminated in a jack plug.

For further information on any of these items, contact Oatley Electronics, PO Box 89, Oatley 2223; phone (02) 9584 3563, fax (02) 9584 3561, Internet <http://www.ozemail.com.au/~oatley>. ♦

The Wireless Institute of Australia's NSW station:

DURAL 40 YEARS ON

Last year marked the 40th year of operation for the radio station run by the WIA's NSW Division, at Dural in outer north-western Sydney. The station has played an important role in the development of amateur radio in NSW — indeed, the whole of Australia — by providing a valuable information service. Here's an article commemorating the anniversary, by past NSW Division president and frequent *EA* contributor Peter Jensen.

by **PETER R. JENSEN VK2AQJ**

To most radio amateurs in New South Wales and for quite a few in the rest of Australia, Dural is a name synonymous with a weekly broadcast of news of amateur radio activities. For just over 40 years the Wireless Institute of Australia's New South Wales Division has operated the radio station at Dural, in north-western Sydney, providing a service which keeps all radio amateurs abreast of current events of interest to the amateur community. The station at Dural is able to put a signal onto virtually all of the band allocations available to Australian radio amateurs, including the long distance communications, high frequency of 14.160MHz and so is able to be heard all over the Pacific and South East Asian region.

As the attached table indicates, the frequency coverage of the Dural station is remarkably large and the process of disseminating amateur news consumes quite a few kilowatts of energy on a weekly basis. Part of the reason for this high consumption of electrical energy is the continued use of amplitude modulation (AM) or 'Ancient Modulation' as it is frequently and disparagingly described by amateurs, for some of the high frequency (HF) signals. The purpose of this is to allow not only radio amateurs but also short wave listeners and those with a general interest in radio (but without access to single-sideband receiving capabilities) to tune in and hear what goes on.

For quite a number of years, Dural has used for the weekly broadcast on a limited number of high frequencies, some substantial commercial broadcast transmitters made by AWA, which make use of 'valves'. Despite the obsolescence of valves, for high power transmission purposes this technology has quite a lot to commend it, being remarkably immune to abuse involving inappropriate loading and standing-wave ratio (SWR) mismatch.

In recent times, Dural has received a



A representative group at the foot of 'that tower'. The author VK2AQJ is at far left, with (L to R) Dave VK2KFU, Tim VK2ZTM, Eric VK2EFY and Owen VK2AEJ.

number of far more modern single-sideband transmitters, featuring solid state componentry, by courtesy of the Police. With the installation of this newer equipment, it may well be that AM broadcasting will at last be phased out — although if sufficient demand occurs, the 80 metre capability could easily be retained.

A small practical problem with these newly acquired single-sideband transmitters is that they are crystal locked to selected frequencies. It may be that the best way to use them will be to employ only the linear amplifiers, with modern solid state transceivers operating as driver stages.

For the substantial number of amateurs who listen in on Sunday mornings at 10.00am or at 7.30pm later in the day, and call back to the duty announcer and engineer after the broadcast, the Dural transmissions represent a valuable way of keeping in touch with current events and other radio amateurs from afar. As a fairly frequent traveller around New South Wales, for me the notion of 'afar' has assumed a particular significance, for it is only by travelling that can one

appreciate the great extent of our State. It was very much for the benefit of the amateurs spread around this vast area that Dural was set up in the first place.

Anniversary date

While there has been a certain amount of argument about the precise

Frequencies in use by VK2WI

(Sundays at 10.00am and 7.30pm)

1.850MHz
3.595MHz
7.146MHz (AM only)
10.125MHz
14.160MHz
24.950MHz
28.320MHz
29.120MHz
52.120MHz
52.525MHz
144.150MHz
147.000MHz
438.525MHz
584.750MHz (by relay)
1281.750MHz
18.120MHz by relay
21.170MHz by relay

plus

date of the original opening of Dural (mainly associated with an erroneous date on the commemorative plaque there), it was celebrated on the 18 May 1997 as the closest Sunday to the correct date — which is now believed to have been the 19 May 1957.

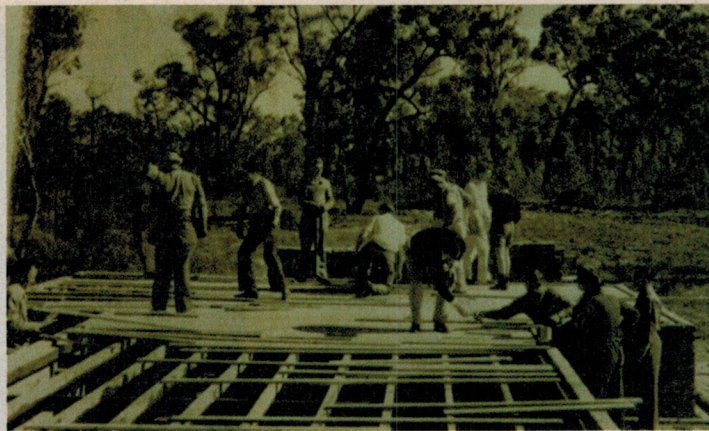
Not entirely by chance, your reporter was the duty announcer at the morning broadcast, ably assisted by the Honorary Secretary of the Division, Eric Fossey VK2EFY, who was the duty engineer. Others in attendance on that fine Autumn morning were the Divisional Director in charge of Dural, Owen Holmwood VK2AEJ and indefatigable station supporters, Tim Mills VK2ZTM and Dave Horsfall, VK2KFU. The Divisional President, Geoff McGrorey-Clerk VK2EO also made an appearance to read a special message to mark the occasion. In addition a number of special historical items were included in the broadcast. Some of those in attendance can be seen in the accompanying photograph. The sartorial splendour of this group is to be particularly admired!

For those with an historical interest and good eyesight, the badge on my cap is an accurate replica of the badge worn by Marconi Marine wireless operators in the early days. A small historical touch to add to an interesting event and a link to the beginnings of radio just over 100 years ago.

How it all began

So how did Dural come into existence? Through a huge amount of hard work of an enthusiastic and dedicated group of amateurs, goaded along by the then-President of the Division, Jim Corbin VK2YC. According to another stalwart of this project, Ric Havyatt VK2PH (then VK2AET), Jim organized a development committee consisting of himself, Eddie Hulme VK2EN, Irwin Stockton VK2AAJ, Dave Duff VK2EO

Laying the floor of the Dural station VK2WI, on 2 September 1956.



and Ric's wife, Val Havyatt. This last named member of the committee was responsible for the ultimate design of the building at Dural, being an architect by training. Ric told me that there may have been a few more on the committee so if there have been any omissions in this list, apologies are extended.

As Ric said in his notes provided for the Dural commemorative broadcast, "Jim Corbin was the driving force for the building in organizing fund raising, getting volunteers for the work, buying the land, etc. Eddie Hulme would have spent more time than anybody else on the site as he was 'Clerk of Works' and organized building material, professional bricklayers, site security, etc. I spent many weekends working on the site."

Val Havyatt also prepared some notes for the Dural Commemoration and described the manner in which the site and building were developed. As she said:

"The site was well and truly in the bush in those days but it had plenty of land, was high above sea level and there no shielding structures or hills nearby. It was an attractive bushland setting, with the land level near the road and sloping away to the north. Electricity supply had already come some distance along the approach road and there were no difficul-

ties in having this extended. However there was no water supply or sewerage."

The simple T-shaped building that can still be seen at Dural was then drawn up by Val. It was designed to be domestic in character and had double cavity brick walls and a tiled roof. One slightly unusual feature was the elevation of the floor level, which is about 600mm higher than one would normally expect in a cottage. This was done so as to make the building less vulnerable to forced entry and vandalism, with the windows set higher off the ground than normal. In a further endeavour to resist vandals, the windows were metal framed with 'Georgian Wired' glass.

One interesting small feature of the original building was associated with a major change to transmission technology that happened in that period. As Val pointed out, small panels were provided high in the brick walls to allow the passage of open wire feeders but in the event, these were never used as the newer arrangement involving coaxial cables was employed and these were brought in below the floor of the building.

With the unavailability of the sewerage service, in the early days a 'Dinkum dunny' was provided, located well away from the main building, down the slope



Above: The official opening of VK2WI in May 1957, by then Minister for Communications Sir Alan Fairhall VK2KB. Right: An early operating console at VK2WI.



Dural 40 years on

to the north. In more recent times these facilities were abandoned in favour of a conventional system involving a 'septic tank', when a mains water supply became available to the site. Unfortunately, for whatever reason, the outlet from the WC was laid too flat and from time to time blockages tend to occur — lending a particular and special quality to the atmosphere of this beautiful bushland site. Fortunately for the visitor this problem has recently been rectified and now you can be sure that the facilities are quite modern and no unpleasant 'backing up' occurs.

In addition, in order to allow an extension to be constructed at a later date, the foot of the 'T' was built as stud framing with a sheeted exterior. Over the 40 years since the building was completed, the extension has not occurred. Maybe with the Olympic Games impending in Sydney coupled with an anticipated influx of visitors, now might be a good time to consider doing something to finish off the VK2WI radio station. Perhaps this time, facilities for making television film and multimedia programming for use on the Internet would not be inappropriate.

As compared with the trials and tribulations that one can expect to be associated with a contemporary development, the handling of the building application by the Council caused no problems and the consent was issued and work began. As the Honorary Architect observed,



VK2WI as it appeared from the street in 1997 — it would still be instantly recognised by those at the official opening.

this was no doubt because the Dural site was too far away and isolated for the Council to be concerned with either its proposed use or method of construction.

Val's description of the surrounding area makes particularly interesting reading, given the extent of development that now can be seen in the Hornsby Shire. The present situation, to be observed by radio amateurs approaching the station from the south and coming along Newline Road, for example, is quite different from that described for 1957.

It's evident in 1997 that development is rapidly moving towards the station and in a few years time, if there are further releases of land for residential purposes, there could be far more aggressive and sensitive neighbours than the horses that graze next door at present. Perhaps the Divisional Council should

give some thought to extending its ownership of land in the vicinity of the station, to ensure that an adequate electromagnetic 'buffer zone' is created.

Much unchanged

Over the 40 years of activity at Dural, much remains as it was when the station was opened originally. Conspicuous by their absence are the rainwater tank and the 'al fresco' toilet facilities. However, in other respects, apart from a huge lattice tower erected in recent times by a lease holder of the Division, the station would be instantly recognizable by those that attended the opening ceremony.

Internally, the most obvious change is in the technology, which has steadily become less massive as transistors and solid state technology has ousted the reliable but large and hot valves of an earlier era.

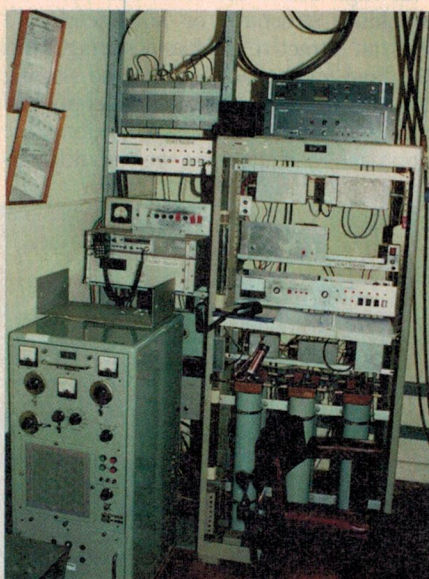
Amateurs in New South Wales have a lot to be grateful for in this major capital acquisition of an earlier generation of radio amateurs. Not only has it allowed all of the operators in country areas to keep in touch; but also in itself, it represents a valuable investment which, with the changing face of Sydney and its inexorable growth, will only increase in value in the future. Well done, Divisional Council of 1957 and thank you one and all.

References

Unpublished material supplied to the author by Mr R Havyatt VK2PH and his wife, architect Mrs V. Havyatt.

'VK2WI — Headquarters Station of the VK2 Division etc', in *Amateur Radio* for October 1958 (p28).

Photographic material provided by the Secretary of the NSW Division of the WIA, Mr E. Fossey VK2EFY, and from the author's files. ♦



Some of the current equipment at VK2WI. At left are the AWA transmitters used for AM, with the 2m VHF repeater at right.

FLUKE'S NEW 79 III TRUE-RMS DMM

Famous for its high quality test instruments, Fluke Corporation has just released some new additions to its range of handheld digital multimeters. The new 79 III high-end model offers new styling, a case with integral protective 'boot' and other welcome features — along with traditional Fluke quality.

by JIM ROWE

A digital multimeter is a digital multimeter is a digital multimeter — right? In theory, perhaps, yes; but in practice there are big differences even between handheld DMMs.

It's true that nowadays they all tend to have an LCD screen at the top, a range switch and pushbuttons in the centre, and some test lead jacks at the bottom. But that's a bit like saying that all cars have a wheel in each corner, an engine at one end or the other and some seats in between for the driver and passengers. As with cars, the similarities are often of little relevance when it comes to choosing the best DMM for the job...

Fluke has been making DMMs for just about as long as anyone, and also has an enviable reputation for making good, *reliable* test instruments. They're generally not cheap to buy, but in the long run they usually turn out to be surprisingly cost effective. It's not at all uncommon to check an elderly Fluke DMM with a calibrator, and discover that it's still within specs — despite many years of day-to-day usage.

Any new instrument from Fluke is therefore of potential interest, and the new model 79 III is no exception. Not surprisingly it has all of the measurement ranges and facilities of previous high-end Fluke models, housed in a new case with ergonomic styling and an integral rugged overmolding which obviates the need for a separate protective 'boot'. The ruggedness and safety aspects have also been upgraded, to conform to 600V CAT III, 1000V CAT II and IEC 1010-1 specifications.

The new meter measures DC and AC volts, DC millivolts, DC and AC current, frequency (to 20kHz), resistance, low resistance/continuity, capacitance and diode test. It has a basic 4000-count display with large digits for readability, together with a frequently updated bargraph type analog display for convenience when monitoring peaking, nulling or trending. The basic DC accuracy is 0.3%, and it offers true-RMS measurements for higher accuracy AC volts and current measurements, especially when the waveform is non-sinusoidal.

Handy features like Fluke's Automatic Touch Hold facility are still in evidence, as you'd expect, along with manual ranging over-ride and easy selection of the second mode for each position of the range switch, using the yellow button. An especially nice feature is the ability to automatically zero-out the test lead resistance on the 40Ω range, simply by touching the RANGE button briefly.

Another bonus with the new integral protective boot is a built-in swingout probe holder at the rear, in addition to the usual swingout tilt-



ing/hanging bail. This makes it particularly easy to use the meter for measurements where you can't keep looking back at the meter's display — and you don't have an extra hand to hold it, as well as the two probes.

On the bench

We used the preview unit shown to make a range of representative measurements on the bench, and found it very convenient and intuitive to use. We also checked its accuracy against our reference instruments and working standards, and confirmed that it was well within Fluke's specs (surprise!).

The only slight disappointment was that although the box contains a thick bundle of folded-up instruction sheets, most of the bulk is due to these being in 15 languages. The English sheet is pretty brief — although probably quite adequate for most users.

Our impression of the Fluke 79 III is that it's very much up to the standard we've come to expect from this maker. So if you're in the market for a good high-end handheld DMM, it's certainly well worth considering. ♦

Fluke 79 III Multimeter

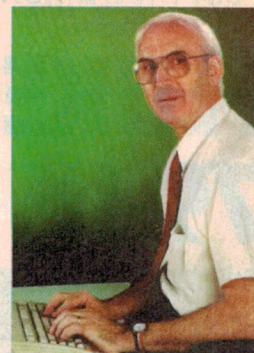
A high quality handheld DMM offering 4000-count readout, true-RMS AC measurements, a case with integral protective boot and improved electrical ruggedness and safety.

Good points: Fast-response analog indication, built-in swingout test probe holder. Automatic cancellation of test lead resistance for low ohms range. Nice feel in the hand.

Bad points: Nothing significant.

Price: \$365 + sales tax where applicable.

Available: From all Philips/Fluke dealers.



More on dubious electrotherapy devices — plus autotransformers & sensitive ICs

Did we attract your attention with last month's column, on dubious electronic devices that are claimed to cure all kinds of diseases? If so, you might find this one interesting too, because our correspondent Cheryl has sent me some *more* information about this 'dark side' of electronics. See what *you* think, about gizmos that 'regenerate the Earth's natural frequencies' to counter EMR, or produce 'colloidal silver solution' claimed to be a miracle antibiotic, or supposedly eliminate driver fatigue by eliminating the 'unhealthy radiation' from a modern car's alternator...

If you *did* read last month's column, you're no doubt aware that the concerned former nurse who drew our collective attention to the growing 'electrotherapy' industry wished to be known only as 'Cheryl' — because she has already received threats from people unhappy about her efforts to shine more light on their somewhat dubious activities. She has been completely open and forthright with me, however, and after checking with the people she gave as referees (like Professor John Dwyer at the Uni of NSW) I'm quite convinced of her honesty and sincere motivation.

Why do I stress this again here? Simply because Cheryl has sent me some *more* interesting and/or worrying information, on devices we didn't look at last month. And because these are also being sold here in Australia, no doubt to technically naive and unsuspecting people with health problems, I thought we'd better look at them.

Countering EMR

Right then, let's proceed. First up, I guess most of us would be prepared to consider that some of the electromagnetic radiation (EMR) that pervades our modern society might be adversely affecting our health. There's enough evidence to suggest that this could be the case with things like handheld cellular phones, cellphone base stations, and possibly electric blankets. At the very least there seem to be grounds for wanting more research into the subject.

But guess what? There are already devices available on the market that are claimed to counteract all of this man-made EMR and hence restore your health and well-being. And supposedly

they do this (wait for it) by generating radiations of their own — but at special 'natural' and healthy frequencies...

For example a firm called The Vital Earth Company, based in Lemon Tree Passage in NSW, is selling a couple of devices of this type, called the EarthWave. One is portable and operates from a 9V battery, producing a 'pulsed non-inductive scalar wave' with a range of '1 meter (sic) radius'; the other is larger and operates from an 18V AC plugpack supply, producing a 'sinusoidal non-inductive scalar wave' with a range of '15 meters radius'.

The larger of these units provides a choice of four output frequencies: 1Hz, 3.5Hz, 7.83Hz and 10.5Hz. Each frequency is claimed to have different therapeutic effects, but the 7.83Hz wave is said to be the 'best frequency to counter electropollution, health, body balancing and well-being'. That's supposedly because this exact frequency is generated by the Earth itself, and is known as the Schumann resonance frequency. According to Vital Earth's literature, it's been 'shown to be a vital life support

frequency, so much so that frequency generators at this vital frequency are now fitted to all manned space missions by NASA and Russia — as important on a space mission as Oxygen'.

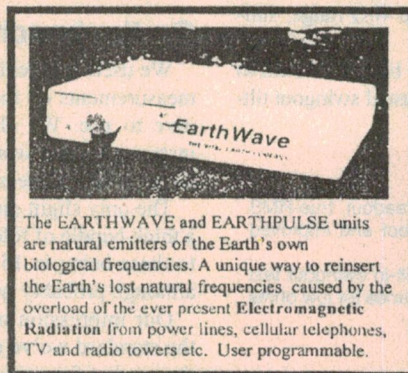
Not convinced yet? Well, according to Vital Earth (whose principal activity seems to be worm farming, according to the NSW Company Register), the Earthwave is a 'creative, enhanced energy device, operating with a primary non inductive Scalar pulse output to offer variable supportive natural frequencies in an Energy field matrix that offers a safe alternative to suffering Electropollution in the home, office, factory, car or travel environment'. So *now* you know! (Assuming you can decipher that gobbledegook, of course...)

Colloidal silver

The Vital Earth Company also seems to sell at least two models of a different kind of device, known as a Colloidal Silver Maker'. Such devices are also available in Australia and New Zealand from other firms, and seem to range in price from about \$100 to \$250 or so, depending on the level of pretension.

As far as I can discover, colloidal silver is basically water containing a very weak concentration of metallic silver ions — in the order of 25 parts per million. Apparently such a weak silver solution has been credited for many years with being a very effective germicide, and able to kill all kinds of bacteria when used either internally or externally.

It seems that there has recently been a renewed interest in colloidal silver, which is now claimed to be an effective treatment for a huge number of diseases and ailments — from acne, appendicitis



An ad for the EarthWave unit...



and athlete's foot right through to diabetes, diphtheria, lupus, malaria, tetanus, tuberculosis and typhoid. (Even syphilis.) Not bad for a few lonely silver ions in a glass of water — which you can drink, gargle, rinse in, spray up your nose or apply as drops to your eyes...

The 'electronic' colloidal silver making devices marketed by firms like Vital Earth appear to be little more than simple DC power supplies (often little more than three 9V batteries in series) which can be used to drive a small current through a pair of silver wire electrodes which are immersed in a container of water, to release silver ions into the water. Sometimes there's a small 'grain of wheat' lamp and resistor in series with the electrodes, presumably to offer either short-circuit protection or provide some sort of indication.

In the latest crop of these devices, this basic setup is dressed up with timing circuitry to 'regulate the colloidal concentration', and/or voltage multiplier circuitry to generate the 27V electrode output from a single 9V battery instead of from three in series. Sometimes the basic colloidal silver generating setup is combined with a Dr Clarke style 'Zapper' unit, so that if the colloidal silver solution isn't totally effective in

killing the organisms responsible for your disease, you can zap them instead!

Another variation on this theme is a device called the Silver Pulser, sold by a firm called Natural Therapy Products, of Turramurra in NSW. This seems to reverse the output polarity as well, at a rate of about 4Hz, and is claimed to be capable of 'neutralising the beasties in your blood' as well as making colloidal silver (with different connections, of course!). It's even claimed to be able to stimulate the growth of your plants — which is probably just as well, because it sells for \$250.

'Keeps you awake'

Feeling somewhat bemused? Don't be, because in the immortal words of Al Jolson, "you ain't heard nuthin, yet"...

Our correspondent Cheryl has admitted that in some ways, the wacky 'electronic therapy' device which worries her most of all is another one sold by the Vital Earth Company. This is the EMR 2000 Driver Fatigue Eliminator, a device claimed to 'virtually eliminate the EMR induced fatigue for all occupants' of vehicles to which it's fitted.

OK, I hear you ask, what's EMR induced fatigue? Well, here's the way Vital Earth explains it in their advertising:

The Vital Earth EMR 2000 Driver Fatigue Eliminator is a passive device designed to act as a 'buffer' to eliminate unwanted radiating frequencies that otherwise interact undesirably with all occupants of motor vehicles. It has been observed that Electromagnetic fields emanate from engine alternators despite built-in rectifiers, and that since the advent of alternators replacing direct current generators, the phenomenon of vehicle occupant fatigue has become a threat to otherwise healthy people, who in some cases when exposed become fatigued and drowsy, the result of which can lead to an accident, even catastrophic loss of life...

...There is no known form of mechanical shielding, so our approach has been to develop the EMR 2000 from a little known but well proven technology developed by French scientist Georges Lakovsky and published in his book 'The Secret of Life'.

Using modern materials and further developments of his findings we have created a 'displaced phase' passive non-linear oscillator, embedded in a matrix of diamagnetic tetrahedral silica quartz to clip unwanted frequencies on the one hand, and to introduce supportive companion frequencies on the other.

The EMR 2000 is fitted directly to the 'heart' of the electrical circuit by connecting the red lead to the battery positive terminal, and the black lead to the negative battery terminal of the vehicle. The EMR 2000 is a passive device, draws no current and needs no replacement parts. It is sold with an unconditional operational guarantee that should the purchaser not experience the benefits of elimination of EMR induced fatigue, then a full refund from the reseller, agent or dealer is guaranteed.

NOTE: No claims are made for the EMR 2000 to eliminate tiredness or fatigue cause by means other than vehicular electromagnetic radiation.

So there you are; if it doesn't do what they claim, you can get your money back — assuming you haven't wiped yourself out by driving head-on into a semitrailer, of course. In any case, how can you tell if your tiredness is due to those nasty radiations from your car's alternator, and not because you've been driving for eight hours straight, after knocking off on Friday night?

I don't know about you, but I have to agree with Cheryl that this device is a real worry. As you can see from the illustration at right, it looks a bit like an electronic version of that notorious 'magic crystal' device promoted by a famous racing driver a few years back, which was claimed to boost the fuel efficiency and output of your engine.

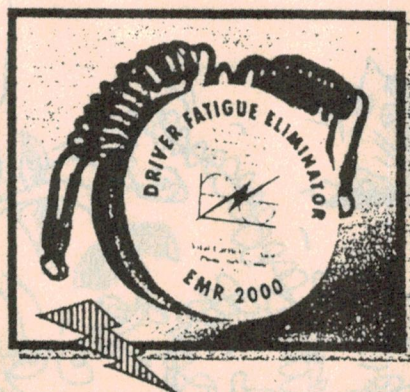
I haven't been able to find out what Vital Earth charges for this device, but what's a life worth? I imagine a lot of gullible people are going to buy and fit one of these dangerous devices, and then undertake all manner of risky driving marathons — confident that it will prevent them from dozing at the wheel.

You'd really think there would be a law against selling this sort of thing, wouldn't you?

Jaycar DOES warn

Changing the subject, you may recall that in the December column, I published a letter from Sydney technician and frequent contributor Phil Allison concerning the safety problems associated with mains stepdown transformers of the auto-transformer type. In the letter Phil stated that although the 240/120V stepdown transformers marketed by Arlec were in fact auto-transformers, *they are not advertised as such and are on sale at Jaycar and elsewhere.*

I have since discovered that although



**BEAT RADIATION WITH
THE E.M.R. 2000**

it's true that Jaycar does sell 240/120V stepdown transformers of this type, they do emphasise in their catalog that the units are of the auto-transformer type and provide no dielectric isolation between input and output. They also provide this warning:

They are OK on most equipment but should not be used on any medical apparatus or equipment which is designed to operate in water or other liquids.

So Jaycar does make it clear that the transformers have no input-output isolation, at least in its catalog. I imagine that the warning they give still wouldn't be sufficient to satisfy Mr Allison, who believes that there could easily be a safety risk with all kinds of 120V equipment imported from the USA and elsewhere — from old TV sets and radios to shavers and hair dryers.

My understanding is that Mr Allison believes that 240/120V auto-transformers should really be banned, as the only certain way to protect people. And perhaps he's right; there's certainly a strong case for it.

I raised this possibility with Gary Johnston, the MD of Jaycar, and he was half-inclined to agree. He explained that for quite a while he only stocked fully isolated stepdown transformers, but then discovered he was losing business to firms selling the much cheaper auto-transformer type. So he allowed his buyers to source some, purely to provide buyers with what they seemed to want.

Gary's position seems to be that if the sale of auto-transformers was banned, he'd be happy to stop selling them. But understandably, he's not keen to do so unless his competitors are prevented from selling them as well...

Static protection for ICs

While I was talking to Gary Johnston, he took the opportunity to comment about the subject of protecting CMOS IC's from damage due to static electricity. This was also discussed in the December column, you may recall; it was raised by reader Mr John Harvey of Clermont in Queensland, and we discussed the very practical problems of ensuring that devices don't get 'zapped' before you buy them.

At my suggestion, Mr Johnston wrote down his comments on this topic and faxed them to me so I could pass them on. Here they are:

In December last year a Mr John Harvey from Qld wrote to you about the 'hoary chestnut' problem of handling IC's that are prone to electrostatic discharge damage. You acknowledged Mr Harvey's experience with similar experiences of your own, and asked readers for suggestions. You finally claimed that 'electronics retailers' might like to hear about such suggestions.

Jim, had you checked with me at the time I would have told you what we here at Jaycar had done about this problem years ago.

As you know, all semiconductors are kept in plastic drawers behind the sales counters. This for a start controls the amount of handling the devices receive. We also have a special code symbol printed on the description label, which alerts our staff that the product inside is a static-sensitive device. In addition, handling and treatment of static sensitive devices is a very early part of all staff training programmes.

I certainly share your reader's concern about the mishandling of static sensitive devices. At the same time, the measures that we have in place have virtually eliminated damage problems in Jaycar stores. Kind regards.

Thanks for those comments, Gary, and it's nice to be reminded that Jaycar has given the problem careful consideration and seems to have developed procedures to keep it under control. I only wish some of the other retailers were able to take similar steps — and I suspect our original correspondent Mr Harvey would agree!

That's about it for another month. I hope we've again given you something to think about, especially with regard to those suspect 'electronic therapy' products. Some of them certainly have the potential to be dangerous... ♦

POPTRON VIDEO SURVEILLANCE SYSTEM

Who's at the front door? Is the baby alright? Do possums really use your attic as an off-ramp at night? Keeping an eye on things is certainly getting easier and easier, now that miniature video cameras have made their way onto the consumer market, so we thought we'd take a look at one of the complete video surveillance systems available from Allthings Sales & Services. The system comes with everything you need — and the results? Every bit as good as we had hoped.

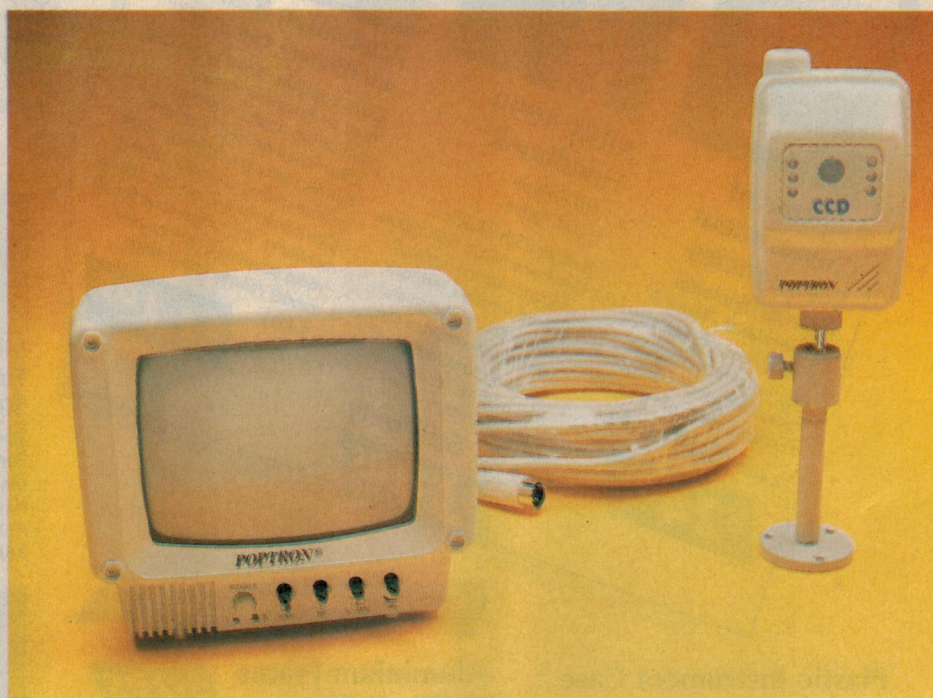
by GRAHAM CATTLEY

With the recent fall in price of miniature video camera modules, the idea of installing a video surveillance system in your home or business looks to be quite a practical proposition. The problems start though, when you realise that you will also need a dedicated television set or video monitor to display the resulting image. So while the cameras themselves may be relatively small and cheap, the cost and inconvenience of setting up the rest of the system often knocks such an idea on the head.

The Poptron video surveillance system provides a low cost solution to this problem, and provides a couple of useful extras as well. It consists of a small CCD camera with mounting bracket, a 5" (125mm diagonal) monochrome monitor, 12V plugpack, and 20 metres of cabling.

The camera is housed in a 100 x 50 x 65mm case, along with six high power infra-red LEDs and an inbuilt microphone. The rear of the casing contains a miniature five-pin connector, and mounting holes for the bracket which lets you mount the camera with almost any orientation. The monitor itself is quite cute, compact and weighing only a few hundred grams — small enough to sit on a desk or shelf without getting in the way. It's standard 'computer beige' in colour, and is reasonably well proportioned. As well as a five-pin DIN socket for the video/audio/power cable, the rear panel provides separate audio and video outputs so you can record everything on a VCR if you want to. On the front panel just below the screen there are the usual brightness and contrast controls, along with a vertical hold, volume control and on/off switch.

Probably the most common use for this system would be for a simple low-cost security system for small shops or businesses, but there are many other uses for such a small and simple system. Monitoring a swimming pool and surrounds, for example, or even keeping an eye on the front gate of a larger



property or farm.

Because of the camera's sensitivity to infra-red light, you can monitor an area in (what seems to be) complete darkness. The six infra-red LEDs mounted on the face of the camera provide enough light to see only a metre or so away, so you will need an external IR light source to see clearly in a larger room or outdoor area. The camera responds well in lower light levels though, so you could probably get away with a small night-light or similar in a child's room, and the setup would be perfect for watching over a baby at night.

The 20 metres of cable supplied should be more than enough for a majority of applications; it's thin and lightweight and would be easy to run between rooms or through walls. Despite its length and the fact that it is carrying both power and audio signals as well, the cable doesn't seem to degrade the picture quality at all; a nice bright and clear picture is displayed on the screen and is more than adequate for monitoring and identification purposes.

The Poptron surveillance system seems to come with everything you need, so you can be up and running straight out of the box. It would make an ideal weekend project that could have some very real and useful applications. ♦

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A complete low cost closed-circuit TV system, with camera, monochrome monitor, cable etc.

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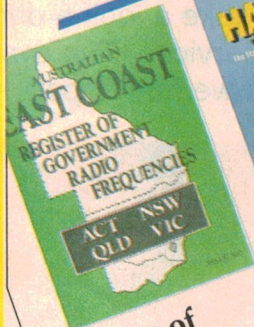
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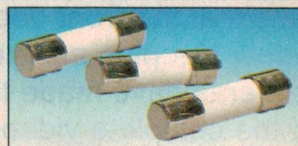
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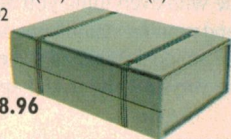
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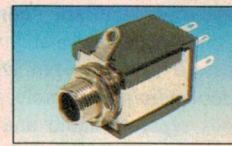
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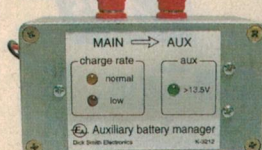
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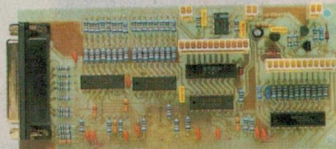
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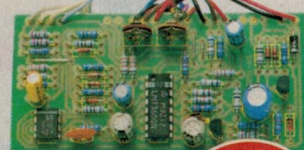
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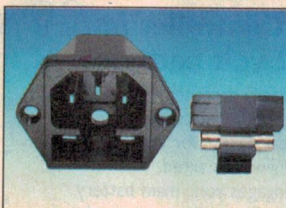
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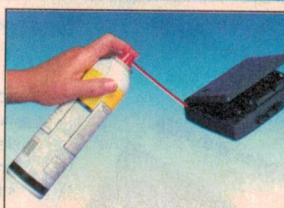
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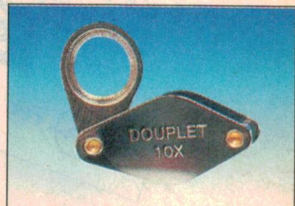
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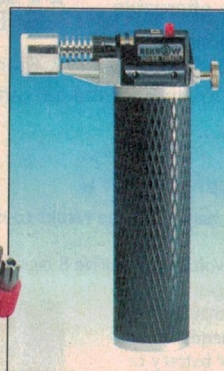
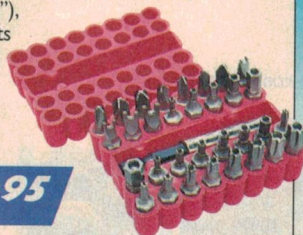
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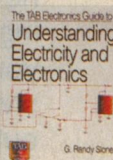
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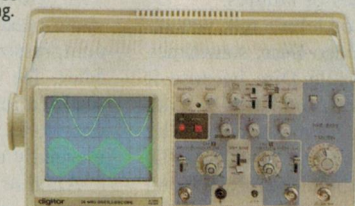


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THE SERVICEMAN

The dodgy repair job that lasted longer than many unrepaired sets do!



I'm kicking off this month's column with a report on the TETIA/TESA Servicing Seminar held last last year in Bendigo, where a lot of us learned some worthwhile tips on servicing recent CTV and VCR models. I also learned a bit about bread-baking machines, as you'll learn. To end up, there's also a story about the frustrations of tracking down an elusive intermittent which suddenly appeared in an elderly colour set — and which turned out to be the result of a dodgy repair carried out 19 years earlier...

A group of 67 service technicians from all States met recently in Bendigo, Victoria. They had gathered to hear specialists from a number of companies and industries speak on the latest technology to affect the industry.

The three-day seminar, arranged by industry organisations TETIA and TESA, was devoted largely to servicing domestic products — TVs and VCRs. However considerable time was given to discussing the economics of the trade, and of ways and means of making a profit from the ever-shrinking margin between the cost of repair and the cost of replacement.

The first speaker was Bert Ferreira, from Mitsubishi Electric Australia Ltd. Bert's theme was "Don't replace the micro-processor!" He described a range of faults that had been confused with microprocessor failure, and suggested ways to confirm proper operation. Replacing a micro usually involves unsoldering 60-plus pins, so it's as well to be sure that the operation is unavoidable before diving in...

Bert's theme became almost the unofficial title of the Seminar, as subsequent speakers took up his catchcry "Don't change the microprocessor!"

The second speaker on the Saturday was Ron Wills, from Samsung. Ron began by explaining why service manuals sometimes don't agree with the set on the bench. Communications between manufacturer and distributor can and do break down, leaving the distributor ignorant of production changes and unable to pass on the information to the service industry.

After that, Ron's subject was largely on power supplies. He showed how the supply is controlled by the micro and why its failure can be misconstrued as a faulty micro.

He also explained why Samsung prod-

ucts, among other brands, contain integrated circuits and other components from many different manufacturers. Although they compete at the sales level, manufacturers are not too proud to use a competitor's component if it is cheaper than a similar product made 'in house'.

The Seminar dinner was held on the Saturday evening, with wives and families joining the gathering to enjoy good food and good entertainment.

Next day it was the turn of John Bishop, National service manager for GE, Telefunken and RCA. John gave us a rundown on the recent GE chassis, then detailed a number of characteristic faults — many of which can again be misdiagnosed as microprocessor failures.

The second half of John's talk was on the latest Digital Video Disc, sometimes called Digital Versatile Disc because it can carry audio, video or CD-ROM data all at the same time. John warned us to be on guard when asked to service DVD, since video discs bought cheaply in Hong Kong or Singapore will not play on the machines that will be on sale here. Early versions of DVD players could be easily converted to different standards, but this facility has been removed from later models and only (highly priced) Australian discs will play on the machines to be released here.

The second speaker on Sunday morning was Terry Scully, of Scully Sound Products. Terry's company is one of the good news stories of the Australian electronics industry. He is successfully selling public address equipment into Hong Kong and Singapore.

His success relies on commanding a very large niche market. He specialises in the design, supply and installation of large PA systems for schools, hospitals, sportsgrounds, airports etc. He stressed that the installation and maintenance of this kind of equipment can be very prof-

itable, and offered his company's assistance to any of the techs present who wanted to get into the field.

The next speaker, after lunch, was Rod Humphris, the well known raconteur from RMIT. Rod was supposed to talk about the latest chassis from Toshiba, and to be fair, he did mention the product. But most of his time was taken up outlining simple and low cost modifications that can make common tools more useful or more efficient.

DIY desoldering tool

Rod also told us that he couldn't afford to buy a vacuum desoldering station, so he built his own — for less than \$50! He used an old soldering iron, some plastic tubing and a 12V volt air compressor bought for \$30 from K-Mart. He claims, probably with some justification, that his home-brew product works as well as any \$1000 commercially made station.

Another one of Rod's side-tracks led to some quite interesting observations about salesmen and customers. He was commenting about the too-frequent requests to set up a product — a VCR or whatever — that the salesman had said was "a breeze to program". Rod detailed one occasion with a customer who asked him to set up a function that she believed the machine could handle. It turned out that the facility was not available, and Rod asked the lady if she had queried this before purchase.

It eventuated that the salesman had spent 30 minutes extolling the virtues of the product and demonstrating its features, never once asking the lady what she wanted it for nor giving her the chance to ask about its functions.

Rod ended up by saying that if he ever ran a course on 'Sales — Product Demonstration', he'd insist that his students learned how to talk WITH cus-

tomers, rather than talk AT them.

To finish off the afternoon, Peter Murray of EFIL (Electronic Faults Information Library) demonstrated the newest version of his product. Like so much other information technology, Peter's library is now available in full multimedia format, on CD-ROM. The old hard-copy version of the library is still available, but even with 40,000 faults, it contains only a fraction of the material now held in the CD-ROM version.

The speaker on Monday morning was Ken Darlington, from NEC Home Products. Ken titled his talk 'Money In The Bank', and belatedly sub-titled it 'Don't change the micro'. He spoke at length about the company's VCR range and some of the characteristic faults that have appeared in recent models. Most of these faults are associated with the power supply, and are easy to diagnose and fix.

It was these 'Money in the Bank' fixes that suggested the title of this talk, and their close association with the micro-controller that suggested the sub-title.

Among the useful hints to come from his talk, Ken included a source for replacement bearings for capstan motors. This led to comments from the audience about other repairs to these often expensive motors. For anyone involved in VCR service, this session

would have been invaluable.

The final speaker at the Seminar was Paul Hutchinson, from the small Victorian publishing firm Paper Works. Early on Paul saw the need for a computerised accounting system for the service industry, and began to write a program to facilitate the paperwork in a colleague's workshop.

Fame spread

The program grew and its fame spread until today, after four major rewrites, it is a complete job tracking, stock control and accounts management tool suitable for workshops of any size. Paul demonstrated the day to day operation of the program, and outlined its application to weekly, monthly and annual reporting.

It's clear that this, or a similar program, will soon be mandatory for anyone trying to make a profit out of servicing domestic electronics. Manual paperwork consumes too much of a technician's time, and a computerised system is the only way to go.

The next biennial TETIA/TESA Convention will be held in Perth, WA in 1999 and is being eagerly awaited by most of those present at last year's function.

I was talking with one of the delegates at the Bendigo seminar and he

bemoaned the fact that he had to go into Melbourne on the way home to western Victoria. I asked why he couldn't go across country, and he explained that he had to collect a load of flour and yeast from a city address. This response interested me, since flour and yeast don't normally appear on a technician's stock order. His explanation was that his workshop specialises in repairing bread-making machines, and he sometimes bakes as many as 20 loaves a day!

I was aware that these machines used some electronics, but I hadn't given much thought as to who repairs them when they break down. Of course, it would have to be the radio and TV repairman, so I resolved to find out a bit more about the subject and to pass it along in these pages.

Unfortunately, I didn't have a chance to quiz the Convention delegate about his experiences as a 'baker', but I did manage to speak with a local chap who rather dashed my hopes of an exciting story. It seems that these machines are fairly reliable and most failures are mechanical, at least with the brand he usually handles.

This particular brand has a plastic coupling between the motor and the 'bucket' in which most of the action takes place. Since the bucket gets quite hot during the baking part of the cycle, the plastic has a tendency to warp and eventually jams the mechanism.

Servicing involves replacing the damaged part or parts, then putting the machine through a full cycle, to ensure that the coupling doesn't slip under load. In this workshop they have fresh baked bread for lunch two or three times a week. But 20 loaves a DAY?

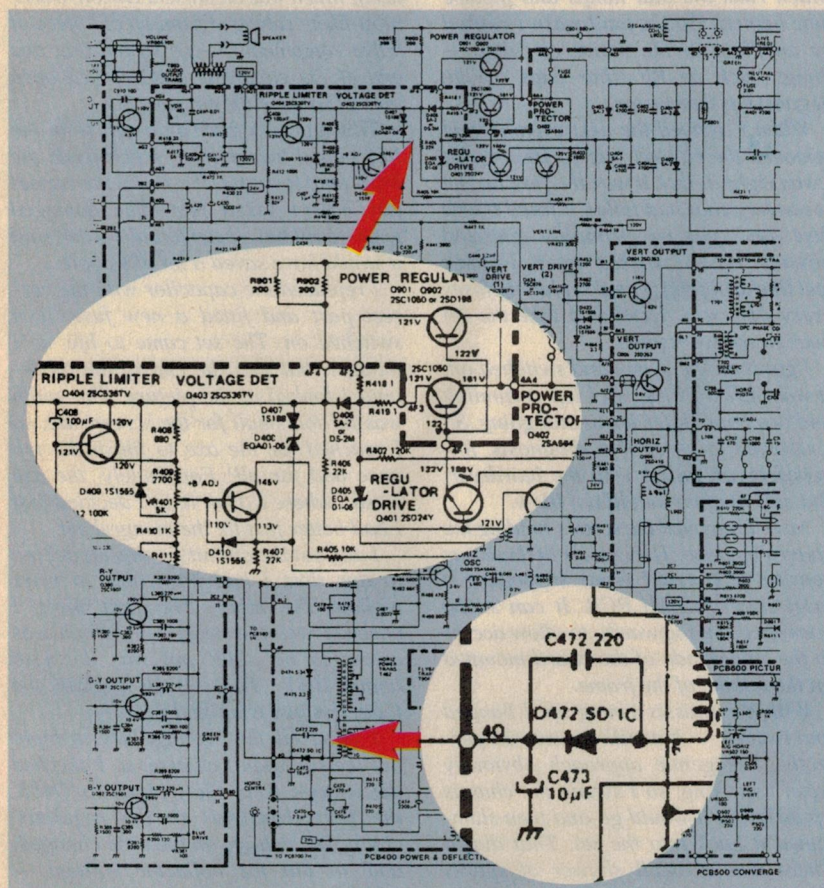
It appears that my western Victorian colleague is beloved of the local old folk's home. All the loaves that are not abject failures are delivered to the home, and are enjoyed by the old folk as a change from commercial bread.

Scary experience

But that's not to say that there are no electronic faults with these machines. On friend of mine had a terrifying experience with a machine not two weeks old.

After the initial novelty of watching bread bake had worn off, the family decided to use the machine's timer facility to bake a loaf for the next day's breakfast. Last thing that night, the machine was loaded with ingredients, the timer set to start the process at 4AM, and off they went to bed.

The power supply and deflection circuitry for a Sanyo CTP7601 colour TV, which is the subject of our story from Steven Ward. The areas of particular interest have been enlarged for clarity.



At about 1AM they were woken by the noise of the smoke alarm in the kitchen and on investigation, found a red-hot bread making machine. The ingredients were a mass of smoking powder and the plastic body was softening and beginning to slump onto the bench.

My colleague turned off the power and carted the machine outside to cool off. There was no other signs of trouble, so they all went back to bed. Next morning, the machine was put under the microscope, to see if it could be determined just what had gone wrong.

The electronics are fairly simple. A microprocessor directs the various functions and the actual control is carried out by a couple of triacs, one in the motor circuit and the other in the line to the heater element. In this case, no fault could be found with any of the discrete electronics. The triacs, transistors, diodes etc were all good. The only apparent fault was an unusual number of shorted-to-ground pins on the microprocessor.

It seems that Bert Ferreira's admonition "Don't change the microprocessor!" may have been, in this case, inappropriate.

Needless to say, the machine was replaced under warranty and the family has almost forgotten the frightening experience. But it does make you wonder if electronic timers on products that run at high temperatures is really a good idea. I feel that manual operation, with someone present to oversee the process, is a much safer scenario.

Shoddy or dodgy?

Now for a story from a frequent contributor, Stephen Ward from Lower Longley in Tasmania. Stephen tells about a repair that, on the face of it, looked like a very shoddy piece of work. However, all is not as it seems since he calls the story 'The Dodgy Job that Lasted 19 years'...

I recieved a call from an old gentleman asking if I could drop in and have a look at his TV, as it had failed to switch on.

I dropped in that evening and he showed me to his elderly Sanyo TV. It was a model CTP7601, which he had purchased in 1975. I switched the set on, but it was completely dead. It didn't take long to find that the main fuse was blown and as the fuse was black inside, it looked like something had gone drastically short circuit.

I checked around the set in the power supply section, testing diodes and transistors but could find no problems; so I fitted a new fuse. I switched the set on, expecting a flash from the fuse but

everything worked perfectly, and I mean like new — the set had an excellent picture, considering its age.

When I commented on the good picture the owner explained that the TV was only used to watch the evening news each night, plus the odd bit of cricket at weekends; so it hadn't had much use in the last 22 years. According to the customer, it had never needed repairing in all that time.

With the set still running, I started tapping on all the boards with a screwdriver, but I couldn't provoke the fuse into blowing. I explained to the customer that the fuse had blown for a good reason — but since the set was working now, the reason could be hard to find. So I would leave it at that, and he should call me if it failed again.

The next night I received a call to say the set had died again, halfway through the news. The tuner dial lamps were glowing, but nothing else appeared to be working. This gave me a better idea of the cause of the fault as I now knew it didn't happen at switch on. Also, it sounded as though the fuse on the secondary of the mains transformer had blown this time, leaving power to the 6.3 volt winding on the transformer which runs the dial lamps and picture tube heaters. So the fault wasn't caused by anything in the mains circuitry — things such as RF filter caps or the degaussing thermistor.

When I arrived the next evening and removed the cabinet back, I discovered I was right in that it was the fuse on the secondary that had failed. I fitted a new fuse and you've probably guessed already: the set worked again. I didn't feel like dropping in and replacing fuses every day, so I decided to take the set back to the workshop.

I got it on the bench and switched on. It was still working, so I left it running and two hours later it was still going. So I resorted to percussive diagnosis, followed by an attack with the hairdryer. But still the fuse would not blow.

Next, I removed the screws holding the chassis in place. The chassis in these sets consists of a metal frame supporting a large and crowded PCB. It can swing backwards and upwards, to allow access to the solder side of the board mounted on the bottom of the frame.

With the chassis swung up, I banged and twisted — but still the set ran perfectly. The gentle approach obviously wasn't working, so I swung the chassis up as far as it would go and then slammed it back into the set. That did it. There was a small shower of sparks from the front of the chassis, and the

fuse finally blew.

I swung the chassis back out and inspected the area where the sparks had come from. This made the problem quite clear.

Sometime in the past, someone had replaced an electro (C473) and instead of fitting a circuit board (RB) type, they had fitted an old axial-lead electro mounted vertically on the board.

The lead on one end went through the hole in the circuit board in the usual way. But where the other lead emerged from the top of the capacitor, they had attached a piece of hookup wire and then run the wire around the metal frame at the front of the chassis and then back under the board, where it was soldered to the other PCB pad.

The only problem with this arrangement was that where the wire was located, the frame was jammed into a metal bracket mounted on the bottom of the cabinet — and when the chassis was in place, this metal was at ground potential.

I removed the capacitor and wire for closer inspection. The wire had a black mark where the insulation had been crushed between the metal bracket and the chassis frame.

The interesting thing was the electro itself, which was an ancient Ducon brand, most likely salvaged from an old piece of valve equipment. It was so old that one end of the capacitor had cracked open and let some of the contents out.

This cap is a filter on a rail from the line output transformer which feeds the RGB output stages. It's a pity the capacitor hadn't failed first. The damaged wire would have been found earlier, and it would have saved a lot of trouble...

I replaced the capacitor with the correct part and fitted a new fuse, then switched on. The set came to life, so I thought that was the end of the job — until I looked at the picture. The width was far too small for the screen size, so I reached for the axe to finish the job once and for all! Fortunately, the axe wasn't where I'd left it, so I decided that I had better just fix the mongrel set.

I dug out the circuit for this model (up to this time I had been able to work without the map). The first thing I checked was the main rail, which was meant to be 120V but was down to about 108V. That would explain the fault, but just what had failed?

I adjusted the 'voltage set' trimpot but the rail didn't change, so I checked the voltage from the trimpot to Q403, the first transistor in the regulator chain. The voltage on the base changed, and so did the collector voltage — which went on to the base of the next

The power supply and deflection PCB for the Sanyo, with most of the key components identified. Electro C473 is the one in the centre of the circle — and normally an RB type as shown!

transistor, Q402. So I then checked the collector of this transistor, but there was no change.

This transistor turned out to be short circuit, as was Q401, the transistor it was driving. I replaced these, but when I switched on the fault was still present. The power supply simply wasn't regulating. A further check revealed that the transistors I had replaced were working, but there was a problem with the two main series pass transistors, Q901 and Q902.

One of these transistors was shorted, so I replaced it as well. But this still didn't fix the problem, because although the base drive was OK, the transistors wouldn't pass any current. So it was back to the circuit diagram.

I was starting to wonder if it was a problem with too much current being drawn somewhere else in the set. I noticed the two 10W resistors connected from the collector to emitter of the main transistors were running very hot. This suggested that the main transistors were not switched on, even though the voltages on the transistors suggested that they were functioning.

I continued checking the circuit and measuring voltages, when I suddenly realised I had 10V across the emitter resistors of the main transistors. Considering they were both only 1Ω types, it just couldn't be right. I switched off and measured the resistors and they were both open circuit. This job was going from bad to worse!

I fitted new resistors and switched on, to be greeted suddenly with a perfect picture. I reset the trimpot for correct voltage and left the set running for a soak test.

The set had been running perfectly for about half an hour when the screen suddenly went bright white with retrace lines, then went back to normal after a couple of seconds. It was another intermittent fault — just what I needed after all the time I had already spent on this monster.

The symptoms suggested a fault with the RGB voltage, where the dodgy capacitor had been located. I checked the area for dry joints but found nothing. I measured the resistors and rectifier diode on this rail, but they all measured OK.

I put the chassis back in place and inspected the component side of the PCB where everything looked OK until I noticed what looked like a small blob

of solder on the rectifier diode, D472. I wiped the dust off the component and then noticed a small crack in the case, with the blob of metal protruding through. I felt sure that this had to be the problem, so I fitted a new diode.

A check of the circuit shows the wire that had been attached to the end of the capacitor was connected directly to the 120V rail, so it's not surprising that the power supply had failed when the wire had been shorted to the chassis.

I ran the set for two more days before returning it to the customer. I explained what I had found and he then remembered that the set had been fixed once, when it was three years old.

So although the original repair looked like a dodgy job, it wasn't really since it had lasted 19 years. But why the wire wasn't just run down the side of the capacitor and into the hole in the PCB is beyond me.

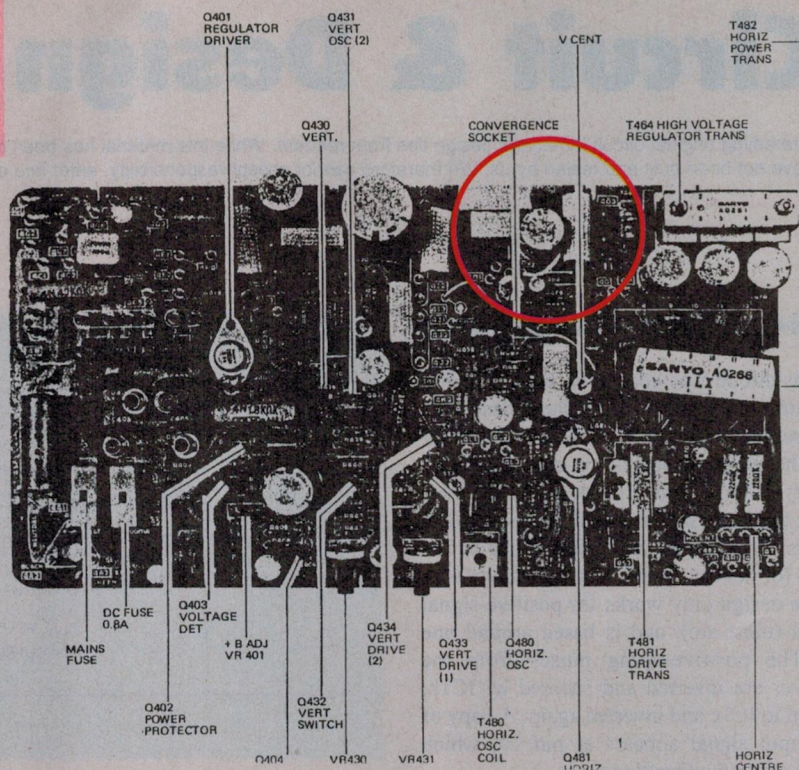
Anyhow I've gotta go now. I need to find my axe, and introduce it to that capacitor...

Actually, I think the Ducon Capacitor (or should that be Ducon Condenser?) should be in a museum instead of on a woodheap mixing it with axes! Anyway Stephen, thanks for that story. It goes to show that shoddy is not always synonymous with dodgy. Nineteen years is not a bad lifetime for any repair — it's longer than the life of many un-repaired sets!

That's not to say that shoddy workmanship is to be condoned. The job

should have been done properly. Which means that the correct component should have been fitted in the first place. Then, if a substitute has to be used, it should be fitted as nearly as possible to the manner of the original. That means using BOTH mounting holes in the PCB, as you point out.

I have more interesting material from Stephen for next month, together with another contributor's report on an alarming design fault that could kill. Don't miss it! ♦



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Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

RC fail-safe with voltage guard

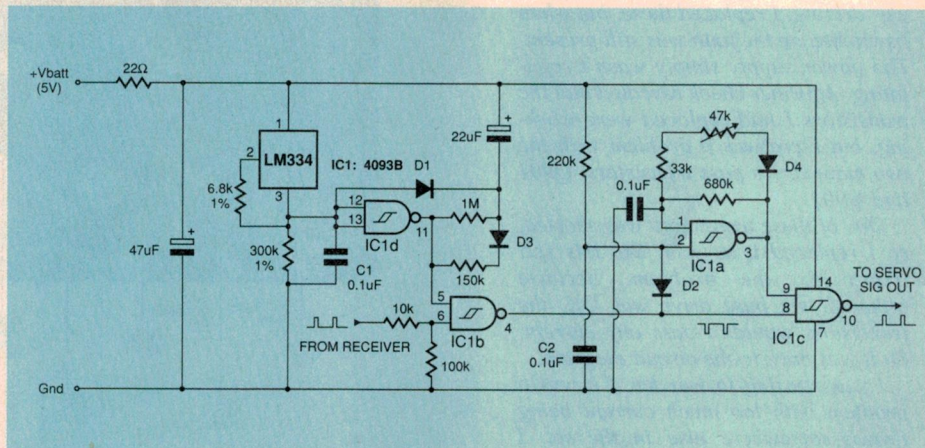
This circuit was conceived when two fellow airomodelers had their planes destroyed in separate crashes — one due to loss of signal, the other caused by an ailing receiver battery. While this circuit only throttles back, to lessen the impact if either problem occurs, it can make a big difference to the plane (or heaven forbid, any spectators!).

The design only works for positive-signal radios (most are), and is based around one IC. The positive-going pulses from the receiver are inverted and squared by IC1b, passed to IC1c and inverted again. A copy of the input signal appears at pin 10, which heads off to the throttle servo.

The negative pulses at pin 4 keep C2 discharged via D2, so that when signal is lost pin 4 remains high and C2 charges rapidly. This pulls pin 2 high and starts the fail-safe oscillator based around IC1a. A negative pulse train is then generated at pin 3, at approximately 50Hz set by adjusting the 47k trimpot. As pin 8 of IC1c is high, the pulses are inverted, and drive the throttle servo at the preset rate (adjusted to low idle).

If the RC signal is regained, the oscillator is disabled and everything works as before.

IC1d acts as a low voltage detector, with a



stable 3V reference produced by passing a constant 10uA (from the LM334) through a 300k resistor. This voltage sits just below the upper threshold point of the Schmitt input with a healthy battery, and so if the battery falls below 4.6V, the threshold shifts and pin 11 swings low. This disables IC1b and initialises a fail-safe by interrupting the received signal. The servo runs to idle until the 22uF capacitor is sufficiently charged by the 150k resistor and diode to pull IC2d's input below its lower threshold via D1. The output then reverts back high, re-establishing

throttle control and discharging the cap via the 1M resistor.

After seven seconds D1 is again reverse biased and the process repeats. This hiccupping of the throttle shows the pilot that the battery is low and it is time to land.

The circuit can be built on a small board and wired entirely inline with the servo lead, in the plane.

Manfred Schmidt
Edgewater, WA \$40

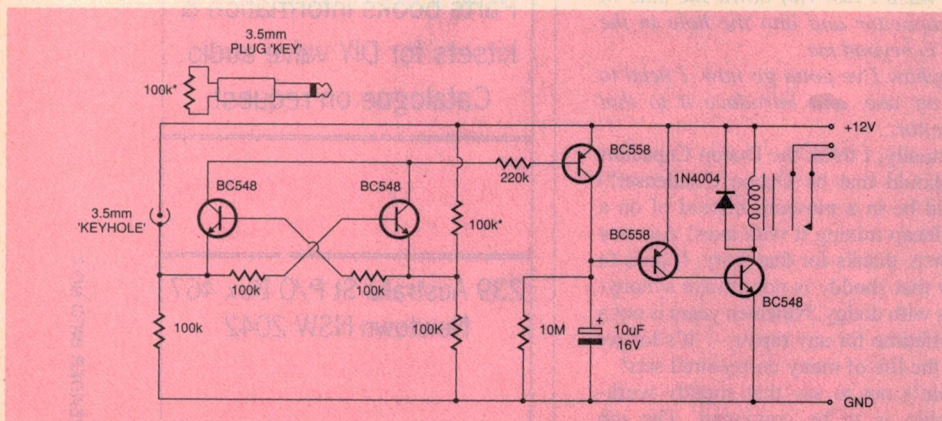
THIS MONTH'S WINNER!

Simple electronic key with time delay

Simple lock/key circuits along this line suffer because they can be easily bypassed by wiring a pot across the key contacts and quickly finding the correct resistance. By

adding a time delay of several seconds, bypassing the key with a 1M pot is a very, very slow process.

The circuit consists of a pair of voltage



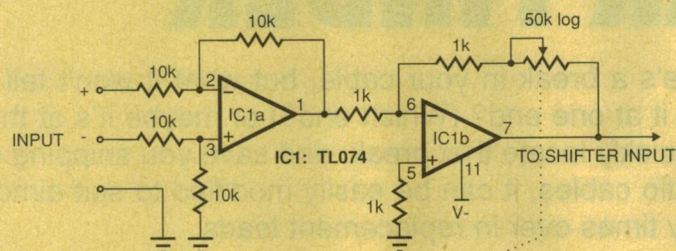
dividers where one element of one of the dividers is the resistance of the plug-in 'key' itself. The time delay (the 10uF capacitor, the 10M resistor and the BC558) gives approximately 10 seconds delay before the relay is activated. To make the key, solder the resistor across the contacts of a 3.5mm mono phono plug, and screw on the back-shell. A matching 3.5mm socket can be mounted on the dashboard of a car or boat, or somewhere near the a motorised door/gates setup.

If at any time an incorrect resistance is across the key contacts, the 10uF capacitor is instantly charged up and the delay is reset. The resistor inside the key can, of course, be changed, but you must also replace the resistor marked with an asterisk to match it. I would suggest that you keep the values between 27k and 470k.

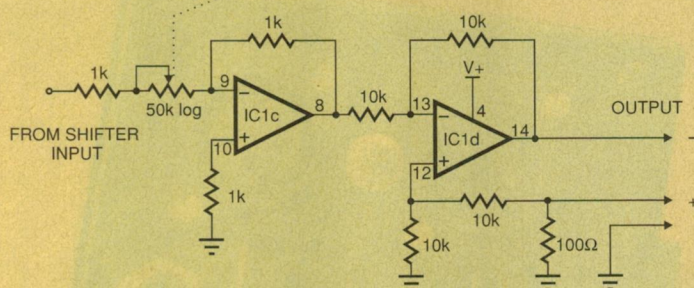
Andrew Merrick
Northbridge, NSW

\$30

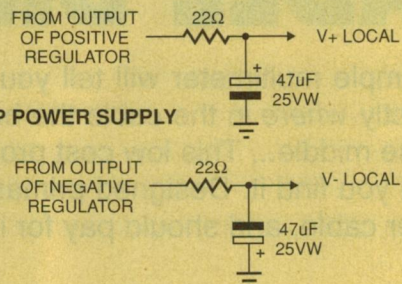
Add-on for the Frequency Shifter Project



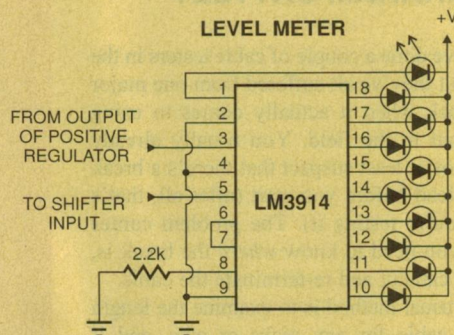
GAIN MANAGEMENT



OP AMP POWER SUPPLY



LEVEL METER



Recently I built the Feedback Reducer for my Children's Primary School and I would like to congratulate the magazine on a fine and well thought-through project. The unit worked on power up and was easy to align. Clever design too.

Feedback is always a problem in a school environment. Little Johnny or Janey are sometimes a bit awe-struck on the stage and have a tendency to mumble, and the gain of the PA is inevitably sitting on the feedback limit. The child is either inaudible or drowned by a howl of feedback. Such complaints filter back to the P&C, who all too often wind up with the responsibility of miscellaneous items like the PA. An opportunity to raise the feedback limit and change the nature of the howl when it does happen are welcome.

However in our school I found that the unit was not always employed at line level. Occasionally it was interposed between a radio mic unit and the main PA amplifier, at levels much lower than 1 volt or so. I found that as the signal was so much lower, the signal to noise ratio was compromised beyond acceptable levels. The hiss was a roar. I could not raise the signal level and had to cope with both line and the lower level sig-

nals depending on the configuration.

So I devised the attached modification which treats the Frequency Shifter as a component and adds a gain stage to the front end, with a variable gain from 1 to about 50. Complementing this is a back end stage with a gain which varies from 1 to about 1/50. These are ganged so that the end-to-end gain is always about 1.

The result is that the unit can be inserted anywhere in the system and the gain adjusted to suit. The input level is always equal to the output but the internal level can be adjusted to suit that required by the Frequency Shifter. The effect on noise with small signals is spectacular, dropping away as the output stage gain is lowered.

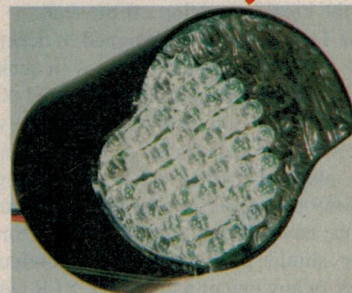
In order to provide a mechanism for monitoring overload, I added a signal level meter based on an LM3914 driving 10 LEDs which look at the output of the input amplifier. This allows the gain to be adjusted so that the Shifter input remains within specification. Make all but the highest LEDs green, with the last one red, and adjust the level control until the red LED is just flashing on peaks. Keep its supply leads separate from the op-amp supply runs, and if the run is long add a 22μF from the unregulated supply to earth.

I also replicated the input stage and output stages to provide a balanced facility should it be required. The pots are dual-gang, audio taper, so as the gain of the input amplifier increases the output amp's gain decreases.

Since school facilities are often a mixed bag, based on history and available funds, I thought this might be of interest to other readers who find the unit of interest but for whom the line level restriction is also a problem.

Fred Stratford
Bray Park, Qld. \$40

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WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at \$369.00!

CABLE BREAK FINDER

A simple multimeter will tell you that there's a break in your cable, but what it won't tell you is exactly *where* in the cable the break is. Is it at one end? (Which end?) or maybe it's at that kink in the middle... This low cost project can quickly locate that break, and save you snipping off bits until you find it. Designed primarily for audio cables, it can be easily modified to suit almost any other cable, and should pay for itself many times over in replacement leads.

by GRAHAM CATTLEY

We've done a couple of cable testers in the past, but they've all suffered from one major drawback when it actually comes to using them out in the field. You usually already know, or at least suspect that there's a break in the lead before you start (after all, that's why you're testing it). The problem comes when you need to know *where* the break is, so you can cut and re-terminate the cable.

The usual method is to examine the length of the cable for any nicks or cuts, and if there's nothing out of the ordinary to then assume that the break occurred at the base of one of the connectors. If the cable has suffered a fair amount of (physical) abuse, or has been stretched, you may well not be able to locate the damaged point visually. And if after snipping off both ends you still haven't found the break, your usual options are to consign the remains of the cable to the bin, or to apply the 'binary division' method — which guarantees finding the break, but also guarantees that the longest piece left over will be half the length of the original cable, or less.

The Cable Break Finder comes to the rescue in this situation, by giving you a simple indication (in percentage) of the location of the break in the cable. You simply plug both ends of the cable into the tester, rotate the knob until the LED comes on and then just read the break's location off the dial.

The Finder has been designed to accept a range of standard cable types, with sockets provided for RCA, 6.5mm phono and XLR (three-pin Cannon) connectors, and will work with cables with any combination of these plugs and of practically any length. The only proviso is that the cable to be tested must have at least one good conductor — either shield or core for two-conductor cables, or any one of a three-line XLR cable.

The circuit

The circuit is based on the age-old principle of the RC bridge. You may not spot it straight away, but it's there, based around VR1 and SW1. Fig.1 might help clarify things a little — it's essentially the same circuit, but in a more conventional layout.



As you can see, an AC signal is applied to the top corner of the bridge, with the voltage at point B being proportional to the position of the potentiometer's wiper. Similarly, the capacitive reactance of each of the two capacitors will result in an AC voltage at point A that is proportional to the ratio of the two capacitive reactances. The meter measures the voltage difference between the two sides of the bridge, and will read zero volts when the ratio of resistances above and below the pot's wiper matches the ratio of

the two capacitor reactances.

As an example, suppose C_x is 25pF and C_y is 75pF. This will mean that the reactance of C_x will be three times that of C_y . As the potentiometer is turned up (from ground) to 25% of its travel, the voltages at points A and B will become equal and the meter reading will fall to zero.

In the Break Finder's schematic (Fig.2), you'll see that the same bridge circuit is there, with VR1 the balancing pot and the two capacitors formed by the cable to be

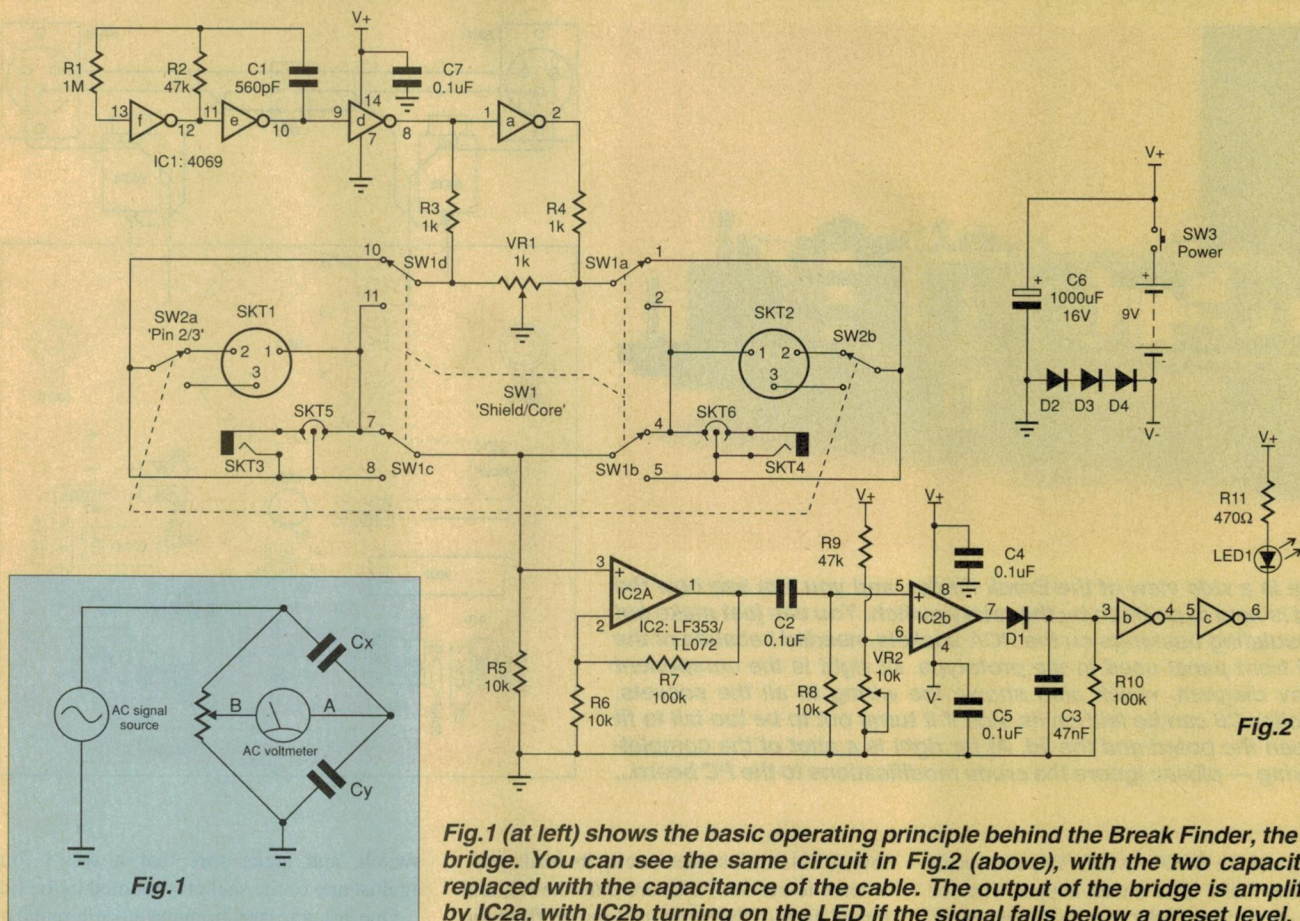


Fig.1 (at left) shows the basic operating principle behind the Break Finder, the RC bridge. You can see the same circuit in Fig.2 (above), with the two capacitors replaced with the capacitance of the cable. The output of the bridge is amplified by IC2a, with IC2b turning on the LED if the signal falls below a preset level.

tested. If you think about it, there's capacitance between two parallel wires in a cable, and a broken wire becomes two capacitors, sharing one electrode (the unbroken wire). The 4PDT switch SW1 allows you to swap the connections to the cable so that this shared electrode becomes one corner of the bridge (point A), while SW2 lets you select either line 2 or 3 of a three-way cable.

We're using a square wave oscillator to drive the bridge instead of the usual sine wave oscillator, mainly because square waves are easier to produce. We're also driving the bridge in a bi-polar fashion, to give a ground reference for the detector circuitry. Due to the differentiation of the square wave by the cable capacitances, the output of the bridge will be a series of positive- and negative-going spikes that decrease in amplitude as you get close to the null, and fade away altogether once the bridge is perfectly balanced.

This signal feeds into the non-inverting input of IC2a, where it is amplified 10 times before being sent to the second op-amp IC2b. Capacitor C2 prevents any DC offset that may be introduced by IC2a from affecting the second stage. This second stage is essentially a comparator that compares the amplitude of the spikes with a preset reference voltage, adjusted by VR2 over the range of 0 to 1.2V. If the spikes exceed this

reference, IC2's output swings high and charges C3 via D1.

As you home in on the null however, the amplitude of the spikes will eventually fall below the reference, and the comparator's output will remain low. C3 will then discharge through R10, and pin 3 of IC1b will fall below the gate's threshold voltage. Pin 4 goes high, and pin 6 of IC1c swings low, turning on the LED.

D2, D3 and D4 provide a ground reference that sits approximately 1.8V above the negative rail, to give the op-amps a bit of headroom.

Construction

Construction of the Cable Break Finder is fairly straightforward. Start by enlarging the hole directly under the trimpot to 3-4mm, so that it can be adjusted once the board is mounted upside down in the case. You can then install the six PC pins. These are mounted from the copper side of the board for the same reason; once the board is installed in the case you'll only have access to the copper side of the board.

Install the single wire link, followed by the resistors and diodes. The capacitors are next, taking notice of the polarity of the electrolytic C6. Finally, install the two ICs and the trimpot, leaving the LED and balance potentiometer VR1 until later. For now, set

the trimpot to its half-way point, and check to make sure that you can adjust it through the enlarged access hole.

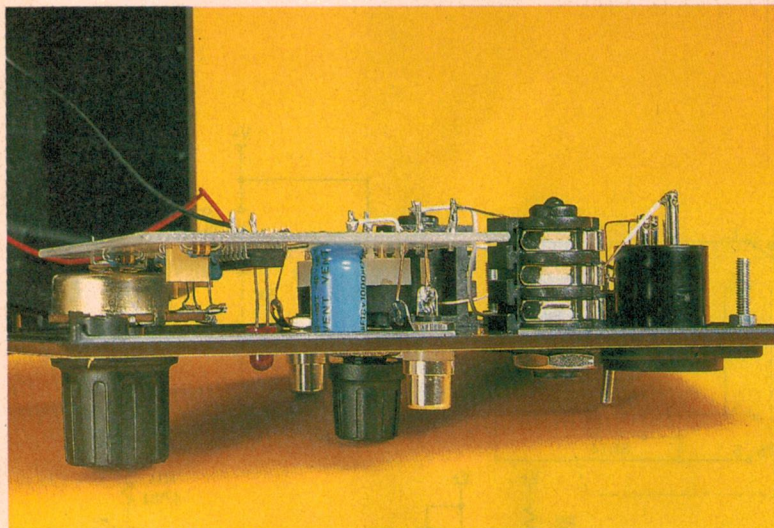
Check also that the rotary switch pins fit into the PC board, as you may need to enlarge the holes slightly to make it fit. Solder it in, and then move the switch's locking ring to limit its travel to only two positions.

Next, you'll have to tackle the front panel; if you don't have a pre-punched lid, you will be busy for the next hour or so — drilling and filing the 10 holes needed for all the knobs switches and sockets. Use a photocopy of the artwork to mark off the positions of the holes, and get to it...

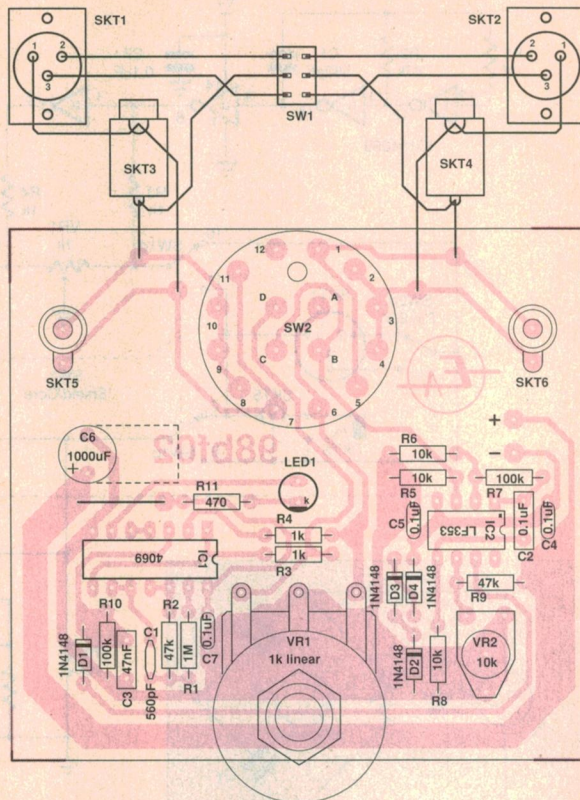
Note that the position of the mounting holes for the XLR connectors may vary depending on the brand and style of connector used, so mark off and drill these holes to suit once you can accurately position the sockets in the lid.

You are probably best off mounting the pot and all the sockets directly on the lid, and wiring them all up afterwards. If you are using a metal front panel then you'll need to use insulating bushings for both of the RCA sockets, as they need to be electrically isolated from each other.

With everything in position, use the component overlay diagram as a guide to inter-wire the two XLR connectors, the two 6.5mm



Above is a side view of the Break Finder, and you can see how the board is held in position by the rotary switch. You can just make out the insulating bushings on the RCA sockets, needed because of the metal front panel used in the prototype. At right is the component overlay diagram, which also shows the wiring to all the sockets. Capacitor C6 can be laid on its side if it turns out to be too tall to fit between the board and the lid. At far right is a shot of the completed wiring — please ignore the crude modifications to the PC board...



sockets and the DPDT switch. You can see in the photo that I used tinned copper wire for these connections, and it was a real pain to do; use short lengths of ordinary hookup wire and you'll find the job much easier.

When you've finished, you should have four wires that connect to the PC board; leave these for now, and instead move on to the pot, LED and RCA sockets. The pot should be mounted with its lugs pointing towards the sockets at the top of the box, and you'll need to solder a 50mm length of tinned copper wire to each lug to connect it to the PC board.

Solder two more 50mm lengths to the shield and tip tags of both RCA sockets as well, and you're almost ready to fit the whole thing together. Drop the LED into the PC board, and splay its leads slightly to hold it in position — check that it's the right way

round, but don't solder or clip its leads yet.

Now lower the PC board onto the lid, and thread each of the wires sticking up from the pot and RCA sockets through their respective holes. Hold the board in place by fitting the rotary switch's nut, and then trim and solder the seven wires you just threaded through the board.

Straighten the legs of the LED, poke it through its hole in the lid, and then solder it in. Trim the shaft of both the pot and the rotary switch, and fit the two knobs — the large one on the pot, and the small one on the switch. The four leads from the other sockets can now be soldered onto their PC pins on the board, as can the negative lead of the battery clip. The clip's positive lead is soldered to a pushbutton mounted in the side of the case.

Use your own judgment in positioning this

switch, and make sure that it won't foul against any of the sockets mounted in the lid.

One last wire runs from the other terminal of the switch up to the positive pin on the PC board. Then all that needs to be done is to mount a 9V battery to the bottom of the case with some foam tape, and to give it a quick test.

The test is to simply push the power button without any cables connected, and rotate the Position pot until the LED comes on. If all's well, the LED will light at the 50% mark. If it stays on or off the whole time, there is a problem somewhere, and it is more than likely to be in the socket wiring.

If the LED lights off to one side of centre, then there are two ways to fix it. The problem is that there is a difference in capacitance between the two sets of sockets, and this is dragging the readings off to one side. The best

PARTS LIST

Resistors

(All 5% .25 watt)

R1	1M
R2,9	47k
R3,4	1k
R5,6,8	10k
R7,10	100k
R11	470
VR1	1k linear 24mm pot
VR2	10k horizontal mini trimpot

Capacitors

C1	560pF disc ceramic
C2	0.1uF MKT
C3	47nF MKT

C4,5,7	0.1uF monolithic bypass
C6	1000uF 16VW electrolytic

Semiconductors

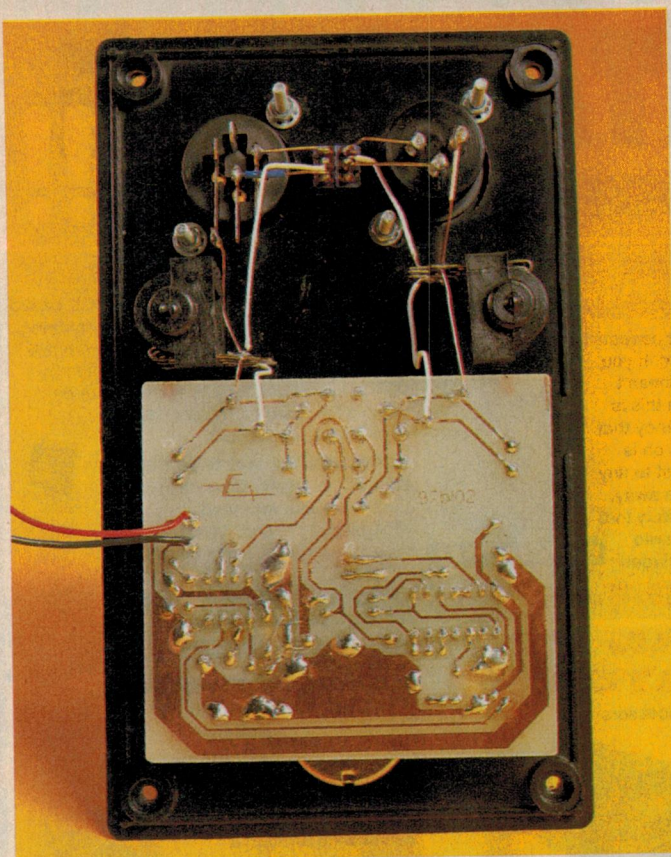
IC1	4069 CMOS hex inverter
IC2	LF353/TL072 Low noise JFET op-amp
LED1	5mm red LED
D1-4	1N4148 silicon diode

Switches

SW1	DPDT mini toggle switch
SW2	4-pole 2-way PC mount rotary switch
SW3	Normally open pushbutton power switch

Miscellaneous

PCB 76 x 70mm, coded 98bf02; Plastic box 95 x 155 x 58mm; 15mm and 22mm plastic knobs; 2x panel mount RCA sockets (with insulating bushings if needed); 2 x 6.5mm mono panel mount phono sockets; 1 x Cannon-style panel mount plug; 1 x Cannon-style panel mount socket; 9V battery snap; 400mm tinned copper wire; Hookup wire, solder, etc.



answer is to compensate by soldering a small value capacitor (try something around 10-20pF) across one of the sockets on the other side. However if the error is quite small (a few degrees one way or the other), you could use the crude approach and simply loosen the pot's nut, so you can twist it around to line things up...

When you are happy with the alignment, you can try it out with a broken cable (or sacrifice one for the job). Set the trimpot to give you a nice tight null that lights brightly and reliably at the break point. Then just screw on the lid, and you are ready to go.

Using it

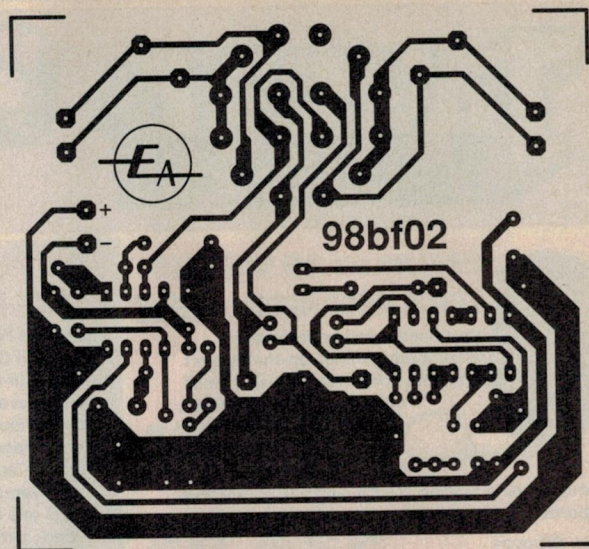
It is important to realise that the Break Finder is just that: a break finder. It can't differentiate between a good cable and a shorted cable, and needs at least one good conductor in the cable in order to work. With this in mind though, testing a cable is quite easy — simply plug both ends of the bad cable into the Finder, push the button and rotate the knob until the light comes on.

If the light stays on throughout the whole of the knob's travel, then flip to the other Shield/Core switch setting and try again. If it still stays on, then there are three possibilities: the cable is good, the cable is shorted, or if one end has a XLR connector, you've been checking the two good lines in a three-line cable. To fix this last problem, flip the 'Pin 2/3' switch and try again.

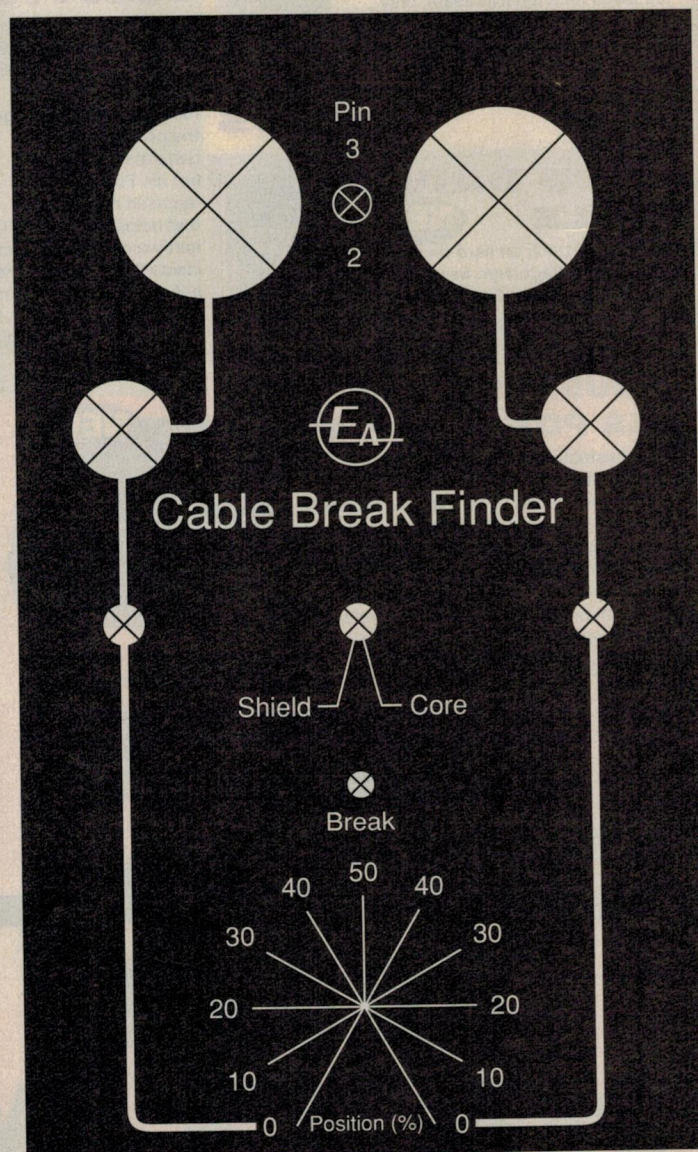
It sounds simple in print, but things can get a little confusing, particularly with three-line cables. I found that the best thing to do was to use a simple continuity tester to see which line is broken, and then set up the Break Finder to test that line, to just find out where the break is.

Intermittent breaks can be found by again selecting the right switch settings for the line with the break, and holding in the power button. The LED should light up, and blink off as you wiggle the cable. Position the cable so that the LED stays off, and then turn the position knob to find the break.

If you need to test cables with other connectors, you can simply wire extra sockets in parallel with those in the case — or make up a couple of adapter leads. ♦



Above is the full sized PCB artwork for the Break Finder, while below is the front panel — again reproduced actual size



Jaycar ELECTRONICS

PRE

CATALOGUE SALE!!!

Prices valid until
February 28th.



MEMOKEY 20 SECOND VOICE RECORDER **NEW**

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Mounted on a keyring, so it's with you all the time. records 3 separate messages, total 20 seconds.

Cat. XC-0275

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By popular demand! Same symbols as our black lettering (NL-2920), only white. At last, professional lettering transfers for black panels! Features 0 - 10 numbers, min./max., volume, balance, arrows, etc. 1 sheet measuring 145x210mm.

Black shown

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Cat. NL-2922

HARD DRIVE BIBLE **NEW**

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Cat. MP-3035



\$49.95

SOUNDFEEDER FM WIRELESS TRANSMITTER

This stereo FM transmitter accepts line level inputs from CD players, etc. If you own a car hi-fi deck that doesn't have line level inputs, then this is what you need. The frequency that the soundfeeder transmits on is selectable, and will transmit to any FM receiver up to 2 metres away. Accepts one single AA battery (not included), with a 3.5mm stereo phone plug input cable included.



NEW MODEL

Cat. AR-1752

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Cat. XC-5045



\$39.95

MINI CAMERAS

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CCD CAMERA WITH CASE, IR LED & LEAD Camera in a box! Complete with lead + RCA plug. Cat. QC-3450

\$159.50

CMOS PCB CAMERA MODULE A great surveillance camera.

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CCD PCB CAMERA MODULE Tiny! Just 32 x 32 x 15mm. Unbelievably small.

Cat. QC-3460 **\$125**

CCD PINHOLE CAMERA Hide the eye! Secure surveillance through a pinhole. Cat. QC-3461

\$125

CCD CAMERA - METAL CASE

Comes in a black metal case, 35 x 35 x 15mm + bracket and lead. Cat. QC-3470

\$145



PERSONAL DIGITAL ORGANISERS

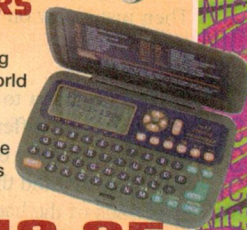
Two great new organisers for 1998. These are both high quality databanks with features only normally seen on big name organisers. Both feature 12/24 hour clocks with world time and daily alarm. Powered by two lithium batteries, each organiser has a large LCD display, auto power off, secret code and free memory indicator. Functions include telephone directory, schedule reminder, memo, accounts memory and percentage. Don't spend big dollars on a personal organiser until you see these.

Cat. QM-7340 32Kb

Cat. QM-7345 64Kb

NEW

**\$49.95
\$65.00**



NEW 1998 CATALOGUE DUE OUT NEXT MONTH

RECORD LOW PRICES ON QUALITY MAXELL BRAND GREEN CD-R

RECORDABLE

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We dare you to find a better deal on genuine Japanese made 74min 680MB recordable CDs
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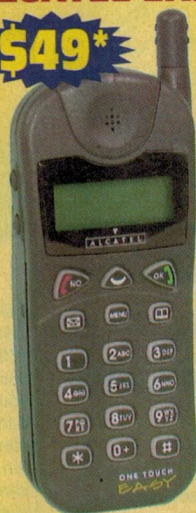
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Cat. YT-7520

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Genuine gold quality JAPANESE MADE recordable CD's at the best price in town! Cat. XC-4710

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10-99 \$5.39ea
100+ \$5.20ea

Remember! Each disc is supplied in a quality CD jewel type (i.e. standard) clear plastic case.

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FEBRUARY
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Was \$29.95
Feb. \$22.95
Save \$7

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Feb. 75c ea

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A heavy duty iron for tough valve chassis, heavy cabling or general electrical work. Fully Electricity Authority approved.
Cat. TS-1485
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Feb. \$20
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This alarm has a built-in passive infra red (PIR) detector and 100dB piezo screamer. There is also a panic button for emergencies. It's 9 volt battery operated (battery not included), or from 240V with an optional adaptor - use Cat. MP-3006 \$15.50. Also includes 2 deterrent stickers. Unit size: 137(H) x 80(W) x 53(D)mm. Ideal alarm for home units garages, caravans, boats, office etc, etc. Cat. LA-5150

Were \$49.95
Save \$20.00
Feb \$29.95



TELKO WINDOW / DOOR MAGNETIC SENSOR ALARM

This small alarm is designed to be mounted on a window or door. When the door / window is opened, a built-in 90dB alarm sounds.
Cat. LA-5165

Were \$9.95
Save \$3.00
Feb \$6.95



TELKO PROGRAMMABLE ENTRY ALARM / CHIME

This unit simply mounts on a door or window. When the door or window is opened the unit either chimes, or the siren goes off. Requires 3 x AAA alkaline batteries (not supplied). Uses magnetic sensor switch for contacts. Size: 132(H)x80(W)x28(D)mm. Cat. LA-5160

Were \$24.95
Save \$7.00
Feb \$17.95



TELKO VIBRATION DOOR / CHIME / ALARM

This unit simply hangs on the door knob inside a room. When the door is opened or shaken it will "sound".
Cat. LA-5170

Were \$7.95
Save \$2.00
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HIGH PERFORMANCE DI BOX KIT

Refer Electronics Australia Feb 1997. A professional direct injection preamp using JFET technology to suit PA and audio recording.

The kit features very low noise, low current drain (via phantom power), high common mode rejection (CMRR) and wide dynamic range. The Jaycar kit is absolutely complete with diecast box, silkscreened front panel, metal XLR connector, PCB, high spec. transformer plus components. Beware of inferior versions of this kit offered by other suppliers.

Cat. KA-1805

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12V 4 CHANNEL LIGHTSHOW KIT

Refer: Silicon Chip January, 1997. Full featured low voltage light

controller. The Jaycar kit includes case, PCB, punched /silkscreened front and rear



panels plus all electronic components. See previous Adverts for full details.

Cat. KC-5240

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REMOTE KEYPAD CASES



Panel punched for LEDs. Hinged door. Size 136(W) x 103(H) x 20(D)mm.

Cat. HB-5600 GREY

Cat. HB-5601 CREAM

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Normally 50c ea

12" PAPER CONE WOOFER



Black cone, rubber surround, 8Ω, 50WRMS. See 97 Cat. page 38 for full details.

Cat. CW-2125

Was \$42.50
Feb. \$32.50
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Jaycar
ELECTRONICS

No. 1

For Kits

CABLE BREAK FINDER KIT

Refer Electronics Australia February 1998.

Your faithful multimeter may tell you there's a break in your cable, but won't tell you where in the cable the break is. Is the break at the centre, or at the end (which end)? This tester tells you where - saving service time and eliminating the need to cut off connectors in a vain attempt to locate the fault.

Kit is complete with case, silkscreened front panel, PCB, RCA, phone and XLR connections plus electronic components. 9V battery and IC socket also supplied at no extra charge.

Cat. KA-1804

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TWO 12V HALOGEN LAMP FLASHER KIT

Refer: Silicon Chip January, 1997.

Flash two halogen lamps alternatively at rates from once a second to once every 3 seconds. Kit is complete with two 50W halogen lamps & holders, PCB plus electric components. Requires 12VAC or DC.

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LINE CARRIER LINK ADD-ON FOR HOME AUTOMATION



KA-1799 Shown

Refer Electronics Australia Feb 1998.

This add-on circuit converts our KA-1799 line carrier link kit from two channels to four channels. In practice, you could add 32 of these modules for a total of 128 commands, so there's plenty of room for experimenting. A fun, yet extremely practicable and versatile project. Kit includes PCB's, switches plus all electronic components.

Cat. KA-1803

\$19.95

LINE CARRIER LINK

Refer Electronics Australia Nov 1997.

Cat. KA-1799

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NEW HIGH PERFORMANCE MODELS FOR '98

REMOTE CONTROL SWITCHES

The Garrison return! These were sold by us previously until they were replaced by lower priced units. Well, what can we say, they are back again! The transmitters feature telescopic antennas for extra range (now an incredible 50 metres), plus sliding covers to prevent accidental transmission. The receivers are mounted within high quality ABS cases. Each model includes two transmitters, receiver and instructions, and security code programmable.

LATCHING UNIT

Includes both N/O and N/C contacts. 11-15VDC input voltage. 24VDC/1A relay contacts.

Cat. LR-8820

\$89.95

SPARE TRANSMITTER

Cat. LR-8821

\$23.95

MOMENTARY UNIT

Receiver features 2 relays, both can be wired in either N/O or N/C contact configuration. Receiver input voltage 11-15VDC, 120V/5A relay contacts.

SPARE TRANSMITTER

Cat. LA-8822 **\$109.95**

Cat. LA-8823 **\$23.95**

** Transmitter size 55 x 37 x 13mm, receiver size 87 x 61 x 33mm. Ideal application include car and home alarms, central locking, appliance switching etc.



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Our new Active Subwoofer Amp Module will deliver 150W RMS into 4Ω and 100W RMS into 8Ω. Its the easy way to add a subwoofer to your existing stereo/ home theatre Hi Fi system. Operates on 240V. Designed to fit into the back of most subwoofer cabinets. A simple 190 x 240mm cutout is required. Hardly any internal volume is lost. Call for specifications.



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This Woofer outperformed most tested in Hot 4's sub car test, & most others were double the price. See Cat P59.

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Cat. TS-1685

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5 in 1 Gas Soldering Iron Kit

This kit uses the same tool as shown above.

The accessories supplied in the kit give it a much larger range of uses. The kit includes: •The tool with metal body •Soldering head and catalyst •5 soldering tips: conical, 2.5mm diagonal, 3.5mm diagonal, 3.5mm chisel, 7mm chisel •Pencil flame head, hot knife head, hot blower head, flat flame head

•Solder sponge •Tube of solder •Case to hold everything

Cat. TS-1690

Piezo Micro Torch

Features include: •Self igniting •Easy to Refill •Adjustable flame •Portable •Cordless •1300°C •Butane Gas Powered Ideal for welding, brazing, wire soldering, jewellery, shrinking heatshrink, plumbing, hobbyist use.

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Size: 1 x 1.5metres. Use with our frame kit CF-2750, or replace worn out cloth or foam. Black. Cat. CF-2752

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Weller® portasol® PROFESSIONAL 100K SOLDERING IRON KIT WITH PIEZO IGNITION



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The Weller PSI-100K is an extremely robust soldering tool kit, which is ideal for trades people and serious hobbyists. Kit includes: •Soldering tool and cap •Soldering tip 3.2mm chisel •Soldering tip 4.8mm chisel •Hot blow tip •Hot knife tip •Sponge and holder •Case

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We've bought a quantity of 9V AC 1 Amp plug packs which are terminated to a 2.5mm DC plug. Fully SAA approved No. N14311

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The Weller station is known as one of the best soldering stations around. It's made in Australia and features a 48W heating element. To change the temperature, simply change the tips! Supplied with a 1.6mm PTAT screwdriver tip. The ultimate for the professional or serious hobbyist.

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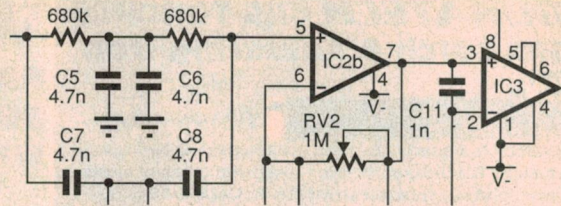
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\$10 Wonders

by OWEN BISHOP



7 - A whimsical musical box

This month we have something a little different: a music box project where the constructional technique is as much a part of the design as the music itself. Adding to the novelty is the fact that it doesn't require a PCB, a stripboard or even a tag strip. Sounds interesting? Read on...

If you have studied electronics for a while, or are lucky enough to have access to a technical library, you may have come across Horowitz and Hill's impressive book *The Art of Electronics**. The underlying assumption of these writers is that, amidst all the hi-tech (and there is an abundance of that in the book), there is plenty of scope left for commonsense, rule of thumb, intuition, and occasionally a sense of humour.

This month we take the book's title literally and introduce a new artform in which stripboard and PCBs are abandoned and the components almost float free in space. For this month's project, we have 'arranged' some components into a musical box circuit, based on one of those ICs intended for use in musical greeting cards. These ICs are quite cheap (under a dollar), and are sold by some of the larger electronics stores like Dick Smith Electronics. Whether this month's project ends up as an executive toy or just a gizmo for the kids, we are not quite sure. But in any case, you can have a lot of fun making it.

One novel feature of the project (apart from the outrageous way in which it is constructed) is that the power supply is switched by a mercury tilt-switch. Normally the device is silent but, when the box is turned the right way up, contact is made and the music begins to play.

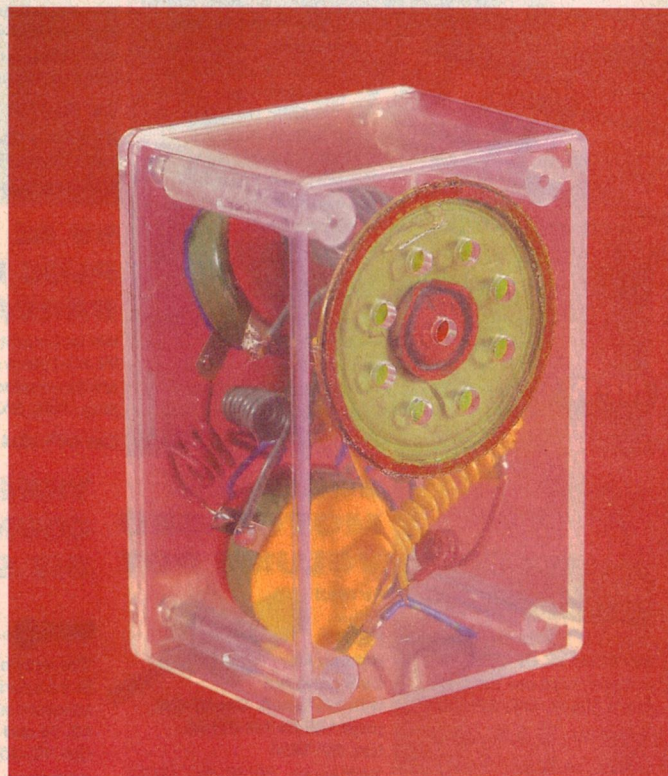
The chip is designed so that when the power is applied, the chip plays through once, from the beginning of the tune, and then stops. This arrangement means that no external controls are needed. The whole circuit is sealed in its box, which is transparent to allow you to view the wonderful works - all ten dollars worth.

The circuit (Fig.1) can be run on 2.4V provided by two rechargeable NiCad button cells, or on 3V from a pair of normal AA or AAA size dry cells. The IC has only three terminals and it comes in a standard TO-92 package. The circuit is about as simple as a circuit can be, but we make up for that by the way we build it.

Construction

It is difficult to give precise instructions on constructing this project because so much depends on the whim and the creative skill of the constructor. Some of the components, particularly the speaker, would benefit from a covering of paint. We used artist's acrylic paint, applied straight from the tube. We chose bright, almost garish, colours but you could employ something more tasteful if you prefer. As you can see from the photo, we used a pair of flat button cell NiCad batteries in the prototype. These have cut-out discs of brightly-coloured felt or cardboard stuck on both sides, but you could do similar things to a pair of standard penlight cells.

Having painted the components and glued the decoration on

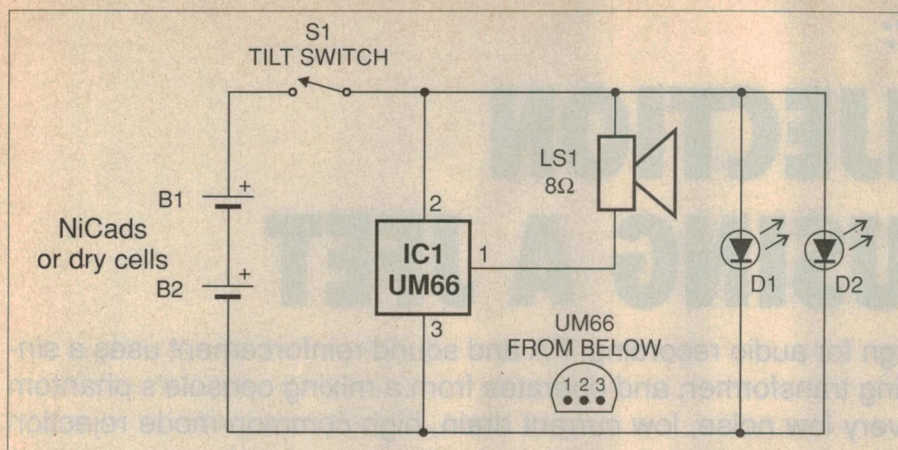


Playing away in all its glory... The transistor-sized chip doing all the work is just visible in the box's bottom left corner.

the cells, we began assembling the circuit. Our approach was to place the speaker face down on the bench and solder the components to this and to each other, while keeping an eye on the circuit diagram. It is important to get all the connections right first time, as un-soldering parts of a three-dimensional network is not easy.

Components can be placed almost anywhere that they fit into place, but keep the box close by so that you can check that the structure does not exceed the dimensions of the box. One essential point is that the mercury switch must be off when the speaker is face down — so make sure that it is orientated correctly. With the speaker face down, the leads of the switch must point up.

The mercury switch we used was the type in which the mercury is contained in a glass bulb. This adds an extra glitter to the project, but if the musical box is intended as a toy for a child, it might be safer to use the type with a sealed metal capsule.



Just seven components! D1 and D2 are flashing LEDs, but you can use ordinary LEDs if you include a dropper resistor. IC1 is able to drive the loudspeaker directly when run from a 3V supply.

The power connections are soldered directly onto the batteries, but if you want a way to permanently turn the thing off, you can do what we did and use a pair of crocodile clips to hook on to leads soldered on to the battery terminals. This method is also good for NiCads in that the cells can easily be removed for re-charging.

LED lights

The LEDs are optional but add to the effect and jazz everything up a bit. You could use ordinary LEDs in various shapes and sizes, but we made the display more effective by using flashing LEDs (the sort with the flasher circuitry built in). These are supposed to operate on 3.5V or more, but they seem to work well at 2.4V. Fit as many of these as you can find room for, and they will all flash at slightly different frequencies so there is an overall sparkling effect. (If you want to use normal LEDs, don't forget to include a 150Ω dropping resistor in series with each LED.)

The transparent box we used came off the shelf at Dick Smiths, but you could use anything else suitable — a clear audio cassette case, for example.

If the box does not already have holes in its bottom to make a speaker grille, drill a few holes before mounting the speaker. When the circuit has been assembled on the speaker, apply a fairly generous coat of clear adhesive (such as 'Uhu') to its rim and press it firmly down inside the bottom of the box. Leave it an hour or so until the glue has fully dried.

Depending on how you have assembled the circuit, you may need a spot of glue in other places, or perhaps some double-sided adhesive tape, but our circuit stayed in place held by the springiness of the connecting wires.

Although the circuit could be built

Parts list

Semiconductors

D1, D2 Flashing LEDs (optional)
IC1 UM66T32 music generator IC.
(Type number differs depending on the tune; several different tunes are available, from 'Mary had a little lamb' through to the Wedding March.)

Miscellaneous

LS1 Low-cost miniature speaker, size to suit box, 8Ω coil
SW1 Mercury switch
2 x crocodile clips; Transparent plastic box approx. 83mm x 54mm x 44mm (Dick Smith stock no: H-2858) or similar; Wire, coloured sleeving, paint, etc.

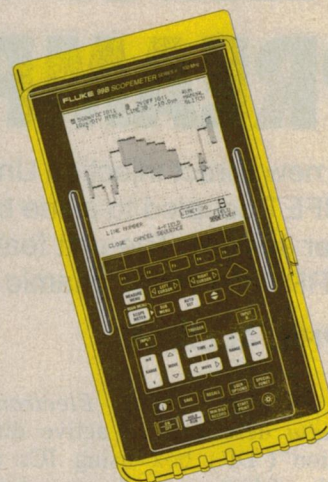
solely by soldering the component leads directly together, there is scope for improving the decorative appearance by leaving some leads long and covering them in brightly-coloured plastic sleeving. Also use single-stranded (for stiffness) connecting wire such as bell-wire for making some of the connections. We wound tight coils of this kind of wire and some of the coils were quite long, going the 'long way round' to reach their destination for effect. We also wound coils around tapering objects and around objects of square and triangular sections — it all adds to the look of the project.

A completely different approach is to have the components at the back and build a small diorama in front, using cut-outs or small model figures. One example that comes to mind in view of the imminent arrival of Christmas is to use the IC that plays three Christmas carols, and to model a miniature Nativity Scene in the box.

Over to you!

(*In case you are interested, the details are: Horowitz and Hill, *The Art of Electronics*, Cambridge University Press, 2nd Edition (1989), 1125 pages. ♦

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Construction Project:

DIRECT INJECTION PREAMP USING A JFET

This new Direct Injection Unit design for audio recording, PA and sound reinforcement uses a single JFET coupled to a line balancing transformer, and operates from a mixing console's phantom power system. The unit features very low noise, low current drain, high common-mode rejection (CMRR) and wide dynamic range.

by PHIL ALLISON

In October 1987, *Electronics Australia* described an active direct injection ('DI') box using ICs and capable of battery or phantom power operation. Kits for this popular design are still available today and represent good value when compared with commercial units.

The new design described here provides an alternative for those who need a DI with higher performance without requiring the option of battery operation. The main improvements as far as the user is concerned is firstly a lower internal noise floor (by almost 30dB) and also the elimination of the need for any switches on the unit.

The battery operation option has been omitted from this design as the vast majority of audio mixing desks, even 19" rack-mount ones, have 'phantom power' fitted as standard and normally supply +48 volts DC at the XLR (Cannon) microphone inputs (see Fig.2).

Why use a DI box?

In a PA or sound reinforcement system and also in recording studios, it is often desirable to feed some signals into the mixing desk without using a microphone. Typical examples are things like electronic keyboards, acoustic instruments with attached or built-in 'bug' pickups, a bass guitar's magnetic pickups or the line output from a bass amplifier — where in each case the electrical signal is used to supply an input direct to the mixing desk.

In all of these cases a means is needed to convert an unbalanced output to a balanced low impedance signal, suitable for feeding down the long microphone cable to the desk. Such a converter is called a Direct Injection unit or DI.

In some cases this conversion unit may consist of no more than a small box

with a pair of 6.3mm jack sockets and a male three-pin XLR connector mounted on the outside, while having a small microphone transformer inside with high impedance and low impedance windings. Microphone transformers require 'mu-metal' shielding if mains hum is to be avoided and a switch is usually fitted to the box to allow disconnection of pin 1 or ground on the XLR, to avoid hum loops where mains earthed amplifiers etc., are being used (see Fig.1).

The performance of such DI's is adequate for those situations where the signal level is relatively high and the effective source impedance is only a few thousand ohms. However with any transformer the input impedance is largely determined by the impedance ratio multiplied by the load impedance

presented by the cable run and desk input. The result is an impedance varying with frequency at the jack input.

This can adversely affect the input signal and often a large peak in the high frequency response is created by resonance effects between the transformer and the high capacitance of long cables. Compounding the above is a general reduction of signal voltage by 24dB or more, leading to noise problems.

The design presented here is a considerable advance over the simple transformer DI and allows correct operation with input signals that are both low in level and originating from a high impedance source, like most instrument pickups and 'bugs'. Background noise is exceptionally low and the author doubts whether a quieter DI exists (see specifi-



cations). This result is achieved by adding a JFET (or junction FET) 'source follower' buffer stage, coupled to a suitable line transformer which provides convenient access to the mixing desk's phantom power system by means of a centre-tapped output winding.

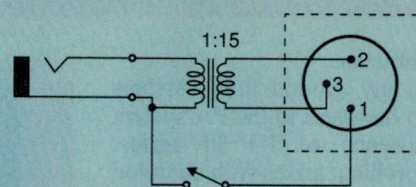
Employing a JFET here rather than a BIFET op-amp or bipolar transistor pre-amp produces the superior noise floor and is the ideal choice for this type of application. The maximum clean signal that can be handled at the input is about 3.5 volts RMS, above which soft rounding of the waveform crests occur rather than the usual hard clipping of an op-amp stage. The combination of very low noise and large input overload margin has meant that no input level switch is needed.

Design details

The circuit diagram shows that the new design is really very straightforward, having only two active devices — both JFETs, with one of them operating as a current source in the power supply.

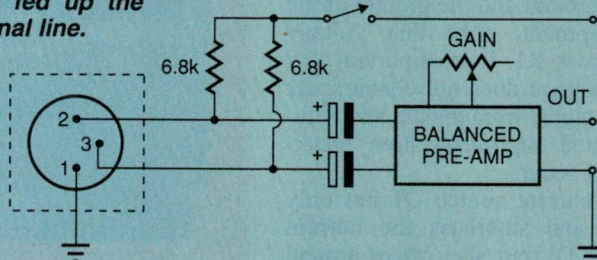
Working back from the XLR connector, the line transformer output winding connects to pins 2 and 3 while the centre-tap provides a 'phantom' supply of DC which has no effect on the transformer since the DC currents and resulting magnetic fields in each half of this winding will exactly cancel each other. A LED in a bezel provides proof that the phantom power is connected and feeds JFET Q1, wired as a constant current diode supplying about 2.2mA. An 18 volt zener diode Z1 limits the maximum voltage at this point in the circuit, while

Fig.1 (right): A simple passive DI box built using a shielded microphone transformer. The switch allows control of mains hum.



SIMPLE TRANSFORMER DI

Fig.2 (below): The input stage of most modern mixing desk channels allows DC 'phantom power' to be fed up the balanced signal line.



TYPICAL
PHANTOM POWERED MIC INPUT

R3 and C1 filter any noise on the supply.

The voltage divider formed by R4 and R5 provides a 6V bias for JFET Q2's gate and C2 bypasses any remaining noise here while R6 feeds the bias voltage and also sets the input impedance of the preamp. R6 may be increased in value if desired, up to a few megohms to suit direct connection of piezo-ceramic instrument pickups.

Q2 operates with R8 as a source follower with slightly under unity gain, and C3 couples the signal to the transformer. R7 and C4 isolate the gate bias from the input and couple the signal to

Q2's gate with a measure of current limiting aided by D1, which prevents the gate voltage exceeding the supply. Jack J1 is nominally the input since it has a shorting link to signals, while J2 provides a parallel output to an instrument amplifier if used.

The functions of R1 and Q1 require a little more explanation. There is no ground switch in this design to prevent earth loop hum. However R1 (100Ω) performs the function of providing an adequate ground for instruments used without another link to mains earth. Extensive trials have shown this to

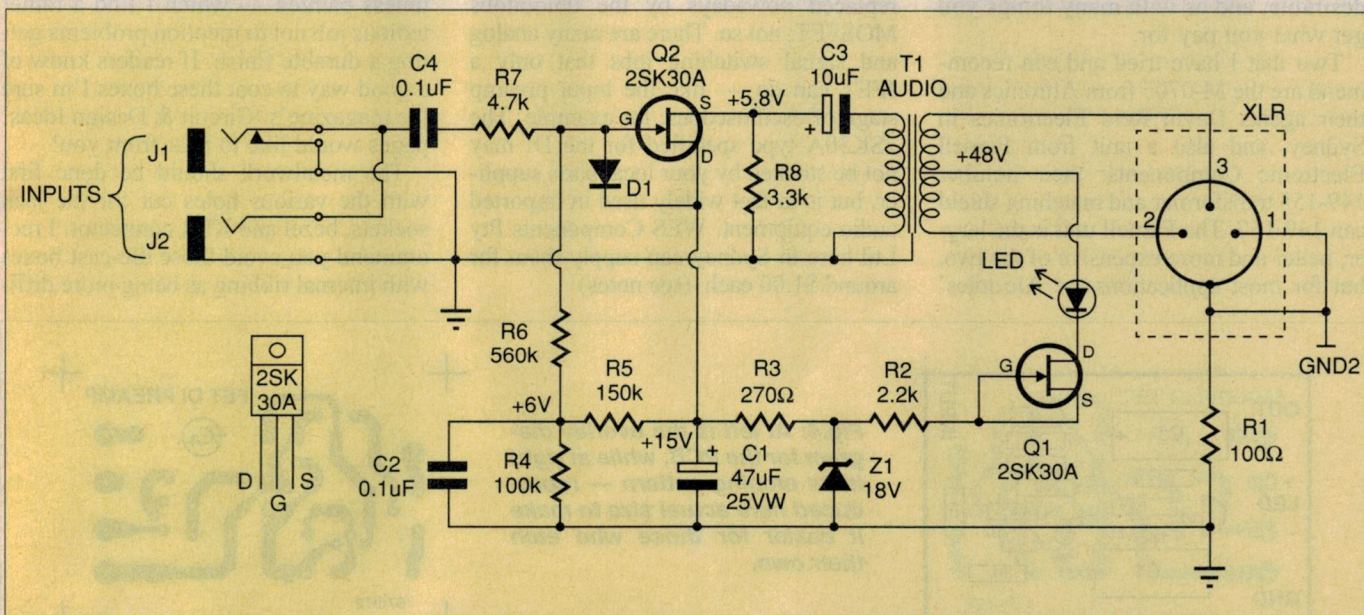


Fig.3: The schematic for the author's improved DI box. JFET Q2 is used as a source follower to provide impedance buffering, while Q1 is used as a constant-current source to improve regulation of the phantom power source.

cause no problems.

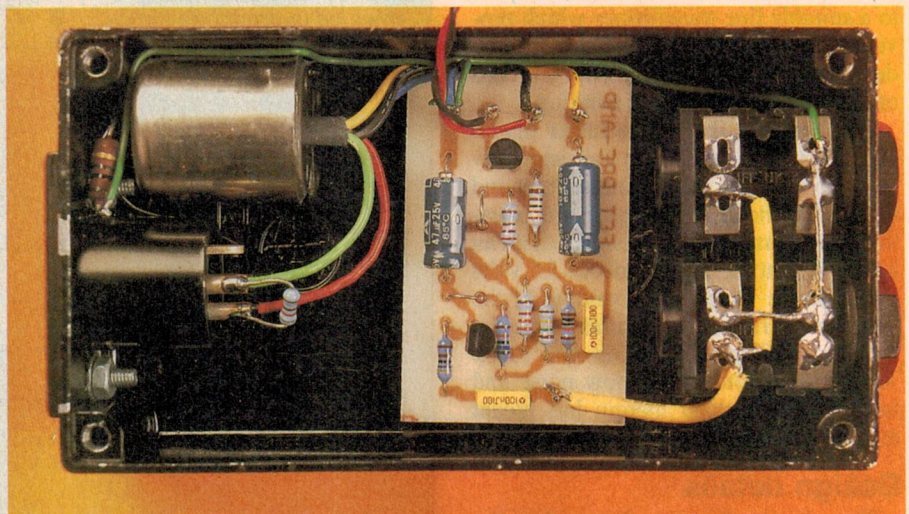
Similarly, any ground hum currents are rendered harmless to the PA system by the presence of R1 in series. However a problem arises with common mode rejection ratio or CMRR within the DI itself. Where a significant earth hum voltage difference exists between the desk's ground and the ground of the stage equipment, then this voltage appears across R1. It is important that this hum voltage does not contaminate the wanted signal from the DI, and without Q1 fitted significant hum breakthrough can occur.

Being a current source Q1 not only minimises and stabilises the current drain of the DI, but also places around 30k Ω impedance between the DI's input ground and the line transformer's centre-tap connection. Measurements have confirmed the rejection of hum voltages across R1 exceeds 80dB at the output, in the prototypes.

The transformer

Suitable audio line transformers for this design are available, but there are not too many choices. An impedance ratio of between 4:1 and 16:1 is needed, along with full audio bandwidth and good magnetic field shielding using mu-metal or similar material surrounding the transformer. The transformer must also have a centre-tap connection on the low impedance winding. Low distortion at low frequencies and minimal leakage reactance are also desirable, and as with many things you get what you pay for.

Two that I have tried and can recommend are the M-0705 from Altronics and their agents David Reid Electronics in Sydney, and also a unit from Farnell Electronic Components: their number 149-155 transformer and matching shield can 149-157. The Farnell unit is the larger, better and more expensive of the two, but for most applications the Altronics'



Use this internal photo of the author's prototype, along with the PCB overlay diagram, as a guide when you're wiring up your own unit. The matching transformer can be held in place using neutral-cure Silastic.

transformer will be satisfactory.

The Harbuch Electronics AT-105 mic transformer also appears to be suitable, but has not actually been tried by the author.

NOTE: Do not be tempted to use any of the miniature unshielded transformers sold for use with telephone lines, as they are not suitable for low level audio work. Much hum and little bass will be the likely result heard.

The JFETs

You may be forgiven for thinking the JFET is almost extinct and has been replaced nowadays by the ubiquitous MOSFET; not so. There are many analog and signal switching jobs that only a JFET can do — like the input preamp stage of oscilloscopes, for example. The 2SK30A type specified for the DI may not be stocked by your local parts supplier, but is in fact widely used in imported audio equipment. WES Components Pty Ltd here in Sydney can supply them for around \$1.00 each. (see notes)

NOTE: Type substitution should not be attempted. No 2NXXXX series JFET is similar enough to work in the circuit as shown.

Construction details

A metal box is needed for the DI, to provide adequate shielding of the high impedance input circuitry, or else a plastic one with metal top and additional tin-plate shielding fitted internally to fully surround all the wiring.

A die-cast alloy box was used for the prototype, which is very strong and has excellent shielding but is rather ugly unless painted — which I find a rather tedious job not to mention problems getting a durable finish. If readers know of a good way to coat these boxes I'm sure the magazine's 'Circuit & Design Ideas' pages would like to hear from you!

The metalwork should be done first with the various holes cut for the jack sockets, bezel and XLR connector. I recommend you avoid those die-cast boxes with internal ribbing as being more diffi-

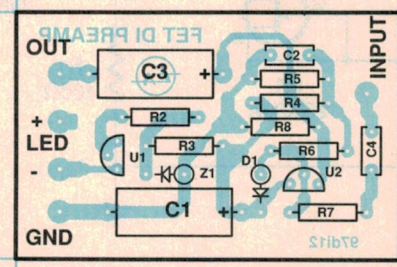
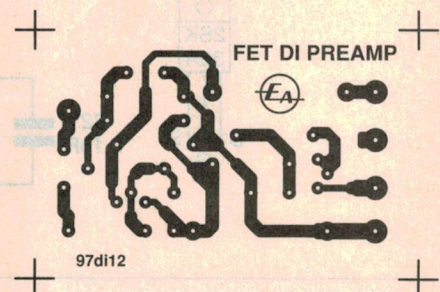


Fig.4: At left is the overlay diagram for the PCB, while at right is its etching pattern — reproduced here actual size to make it easier for those who etch their own.



cult to work with. I also warn against the waterproof type with thick sides and gas-kets, as being both smaller inside than they look from the outside and very difficult to drill or punch the required 19mm hole for the XLR socket.

After drilling your box, de-burr all holes and try to make the fits as close as possible. A tapered hand reamer is invaluable. File off any sharp edges and excess from the casting process. Clean and spray paint if desired; two coats are usually needed for a good finish.

Presuming you have made or obtained the printed board, load all the components starting with the resistors, then the diodes and JFETs and lastly the two plastic and two electrolytic capacitors. After cleaning the PCB with methylated spirits and drying, check carefully for missed or bad soldering and shorts between tracks.

Wire the connectors and transformer to the PCB as indicated in the circuit diagram and overlay diagram. Keep all wiring short and direct — it looks much better that way. See the photos for a guide to wiring.

The line transformer should be held in place with Selleys 'Silastic' roof and gutter sealant (neutral cure type), in clear or white. Place the transformer on a small bed of adhesive and leave overnight to set. The PCB may be held down with double sided tape, or 'Silastic' dopped in each corner after placing a small piece of plastic beneath. Note that R1, the 100Ω resistor, is mounted off the board and connects between the XLR socket earth point and the PCB ground pin.

When wiring is complete check that a multimeter reads 100Ω between the input jack ground and the metal box, and also the XLR socket frame. Do not rely on the XLR socket's own ground terminal, but use a solder lug and star washer under one mounting bolt. Also make sure the lid screws actually ground the lid, by scraping some paint off around the inside edge of each hole.

Commissioning

Testing can be as simple as plugging the completed DI into a mixing desk equipped with phantom power, then checking and comparing a few voltages with those on the circuit and finally seeing if a clean signal is transferred to the desk. Alternatively and preferably, apply a DC voltage of from 20 to 40 volts between the positive LED connection and ground on the PCB and perform checks with a multimeter, audio signal generator and CRO if available. With an input signal up to 3.5V RMS, clean waveforms should be obtained

SPECIFICATIONS	
Frequency response	10Hz to 40kHz +/-1dB
Maximum input	3.5 volts RMS
Input impedance	560kΩ or higher
Output impedance	75 or 150Ω*
Gain	-13dB or -8dB*
Input noise level	-104dB rel 200mV input, unweighted
Harmonic Distortion	0.08% at 200mV input (2nd harmonic) 0.75% at 2.5V input (2nd harmonic)
CMRR	-80dB, 50Hz-10kHz
Dynamic range	129dB unweighted
Supply current	2.2mA constant
Supply voltage	24 - 48V DC phantom
*With Farnell transformer	

PARTS LIST	
Resistors (0.25W carbon 5% or metal film 1% unless specified)	
R1	100Ω (1W)
R2	2.2k
R3	270Ω
R4	100k
R5	150k
R6	560k (up to 2.7M)
R7	4.7k
R8	3.3k
Capacitors	
C1	47uF 25VW PT electro
C2,4	0.1uF MKT 63VW
C3	10uF 25VW PT electro
Semiconductors	
Q1,2	2SK30A JFET (see text)
Z1	18V zener, 400mW
D1	1N4148 silicon diode
LED	High efficiency red LED with bezel
Hardware	
PCB	51 x 33mm, code 97di12
Box	Die-cast, 110 x 60 x 32mm or similar
XLR	Three-pin panel male, black finish
Jacks	Two x plastic 6.5mm mono with switches
Line transformer	— see text for options

Notes

The special components used in this project may be obtained from the following firms:

2SK30A JFET:

WES Components, 140 Liverpool Road Ashfield 2131; phone (02) 9797 9866.

Line transformer:

Farnell Electronic Components (Cat No. 149-155, with shield 149-157), 72 Ferndell Street, Chester Hill 2162; phone (02) 9645 8888.

Altronics and their distributors, Cat No. M-0705. Also from David Reid Electronics, 127 York Street Sydney 2000.

Harbuch Electronics (Cat. No. AT-105), 9/40 Leighton Place, Hornsby 2077; phone (02) 9476 5854.

across R8 and the line transformer input and output windings. The overall frequency response can also be checked using a sweep oscillator like the Miniosc — see *EA* for December 1996.

For the best high frequency response when connected to long microphone lines, a load resistor may be needed across the two signal wires. This is best fitted at the mixer end of the line but can also be inside the DI. A value of about 680 ohms should be adequate to dampen any high frequency ringing and pro-

duce a flat response +/- dB. A sweep test will clear up any doubts.

WARNING: As with all phantom powered DI's and mics, the mixing desk's gain control and fader on the channel concerned should be set to minimum before plugging in the DI, to avoid a large and possibly damaging transient (loud bang) reaching amplifiers and speakers. A similar large transient also occurs when DI's are disconnected. The minimisation of transients was a reason for avoiding switches on this DI. ♦

LINE CARRIER LINK FOR HOME AUTOMATION - 3

In this third article on building up your own home automation system using our Line Carrier Transmitter and Receiver units, we'll discuss a couple of add-on modules that can be used to expand the system's capabilities. The low-cost modules use common parts, are easy to build, and simply 'patch' into the Line Carrier unit's existing circuitry.

by **ROB EVANS**

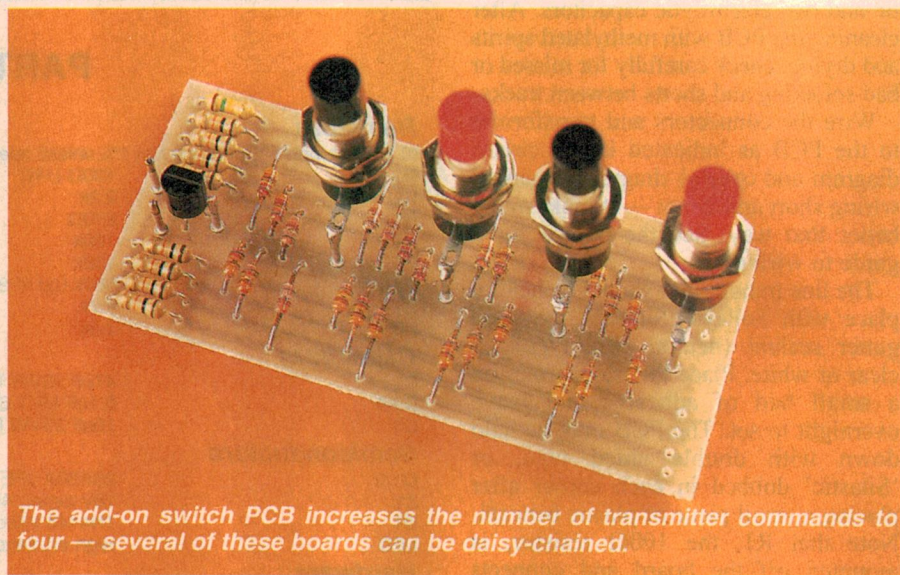
As mentioned in the second instalment, presented in the December 1997 issue of *Electronics Australia*, the design for our Line Carrier system is quite a flexible one and can be expanded well beyond that used in the prototype units. Despite the system's inherent capability of processing 16 address codes and eight command instructions, our prototype setup used just one address and two commands (ON, OFF) to control a single 240V AC appliance. The idea was to present a basic but practical system, which included all of the capabilities for future expansion.

But we've really only scratched the surface of what can be done with the Line Carrier system, so in this article we'll show how to build and connect up an expandable four-way command button module for the transmitter unit, plus a quad TTL-level output latch circuit for the receiver.

These modules should be very useful to those setting up or just experimenting with a home automation system, and when implemented, make the overall system far more capable. (In our next instalment, I'll describe a dual Triac-controlled dimmer unit that has a 16-level range for each independent channel.)

The four-way pushbutton unit presented here is designed to replace the simple two-button setup used in the prototype transmitter, and can be expanded in groups of four via a simple nine-way bus scheme. Since the Line Carrier system can theoretically cope with eight separate commands sent to sixteen different addresses, you *could* add 32 of these modules to the transmitter, for a total of 128 command buttons! However a system of this complexity would be better suited to PC control (as discussed in the December issue), and most systems really just need one or two of these button banks.

On the receiver end of the Line Carrier system, the quad latch circuit expands the unit's output capabilities to four independent 5V logic lines, in place of the single relay output. These lines can be used to control a range of output devices and circuits, including house alarm command panels, relay and Triac 240V AC power switches, digitally-



The add-on switch PCB increases the number of transmitter commands to four — several of these boards can be daisy-chained.

controlled equipment, and a variety of other 5V-based control systems.

Both add-on modules are small and inexpensive, so even if you are just tinkering about with a home automation setup, the circuits are well worth knocking up. All in all, it's a fairly straightforward job to expand the system so each receiver unit has a four-channel (eight-command) capability, which would form the basis of quite an elaborate control system.

When it comes to including the modules in a practical setup though, you will need to take a careful look at the case arrangements for the Line Carrier units, since extra space may be needed to accommodate the add-on units. One or two of the switch boards will probably fit in the original transmitter case, for example, but more elaborate setups will mean that the complete unit needs to be transferred to a new, larger box.

Fortunately though, both the Line Carrier Receiver and Transmitter PCB assemblies are quite self contained, and can be transplanted into another style of box without much difficulty. This job should be completed while using the original construction guide from the December issue as a reference, while as usual

making sure that all exposed 240V AC connections are fully insulated.

Tx switch circuit

The basic circuit for the Line Carrier Transmitter's optional four-button switch PCB is shown in the upper left-hand section of Fig.1 — labelled 'SWITCH PCB #1' and surrounded by a dashed box. The other sections of the schematic are included to show how the switch PCB is connected to the transmitter circuit ('EXISTING TRANSMITTER CIRCUITRY'), and how further switch PCB's can be added ('SWITCH PCB #2') to expand the number of pushbuttons in groups of four.

The four-bank button circuit is a simple diode matrix arrangement, where the transmitter 'programming' inputs at IC1 (P0 to P7) are normally held low by pull-down resistors R11 to R18, and are driven high by pushbuttons PBA to PBD via their associated matrix diodes. As you can see from the schematic, the +5V source for each button is via the base-emitter junction of Q3, which will therefore fully conduct when any of the four buttons is pressed. This in turn pulls the 'GO' line high, which instigates the transmitter circuit by removing the reset on IC2

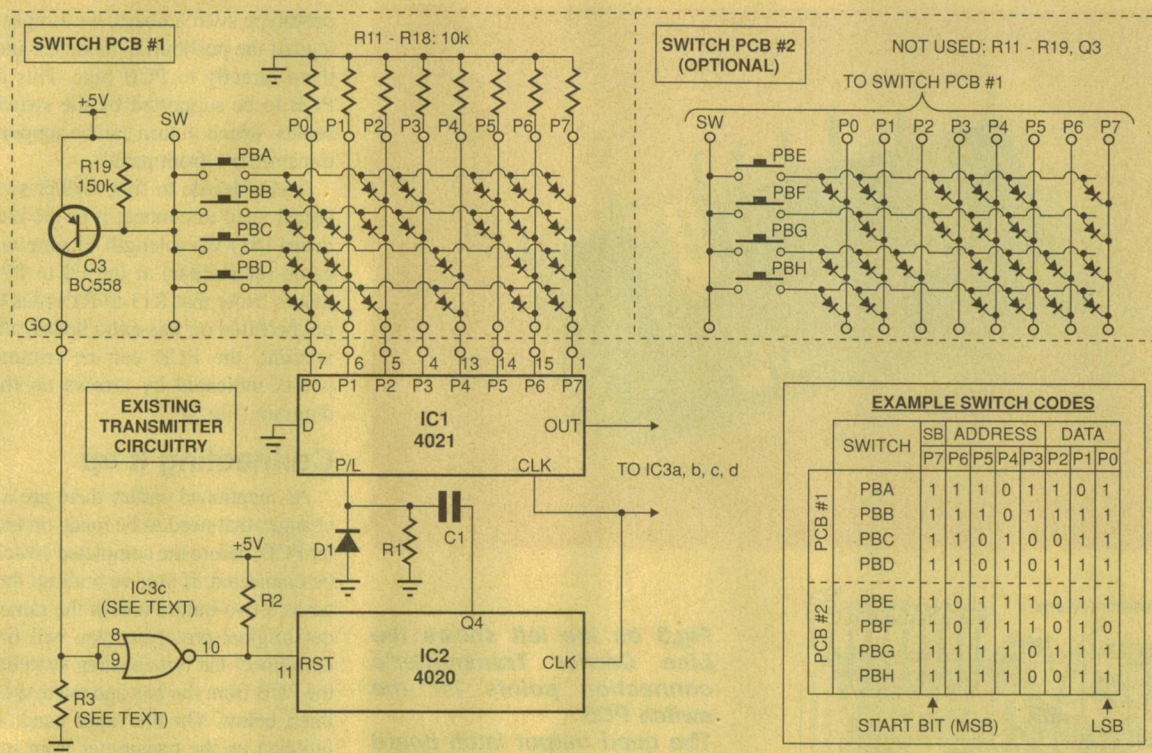


Fig.1: The schematic for the four-way switch board, including its transmitter unit connection points. The circuit for the actual switch board is shown in the upper-left section, surrounded by a dashed box.

via inverter IC3c.

Fig.1 also includes a table (lower right area) showing the coding arrangement for the matrix diodes as shown in the schematic. This includes the codes for our example diode arrangements in both switch PCB #1 and the optional switch PCB #2, and also indicates how the codes divide into the system's address (four bits) and data (three bits) information.

Looking at the circuit for button PBA for example, when this is pressed transmitter input lines P0, P2, P3, P5, P6 and P7 are pulled high via their associated matrix diodes, resulting in an address code of 1101 and a data code of 101 — as shown in the table. The GO line is pulled high via Q3 as mentioned above, and the transmitter repeatedly sends this address/data code down the line while PBA is held down.

Line P7 is pulled high for all button codes by the way, as this is the start bit for each code transmission. Note that while this could have been hardwired to a high level, using the matrix diodes ensures that a start bit can only be sent when a pushbutton is actually pressed — there are occasions where shift register IC1 can still be 'transmitting', despite the fact that IC2 has been reset.

The switch circuit and PCB layout have been arranged so that additional switch PCB's can be added on a 'bus' basis, thereby increasing the number of transmitter control buttons in groups of four. As shown in the switch PCB #2 section of the schematic, the P0 to P7 and SW lines can be linked to those on the main switch PCB (#1), so that buttons PBE to PBH operate in the same manner as before.

Note that pull-down resistors R11 to R18 and Q3 (plus pull-up R19) are not needed on any *additional* switch PCBs. A couple of changes must be made to the Line Carrier Transmitter board to accommodate these modules — see later for details.

PCB construction

Components for the four-button switch module are held on a small PCB coded 981cal (73 x 32mm), which has enough space to accommodate a full set of programming diodes for each switch matrix. The layout of diodes shown in the switch PCB component overlay diagram (Fig.2) matches that of the schematic, so this should give you a reasonable idea of how the diodes are positioned for a range of codes. Note that these are just *example* transmitter codes, and you will need to decide what address and data combinations will suit your particular setup.

This is most easily done by writing down the proposed codes in a format similar to the 'example switch codes' table in Fig.1, then installing diodes in the appropriate positions on the PCB. Note that in all cases, the *anode* end of the diode must face towards the larger copper area in the centre of the board — check your work here before proceeding, as an error can lead to very unpredictable results!

Next install all of the resistors, transistor Q3, plus PCB pins for the external connections. As you can see from the shots of our

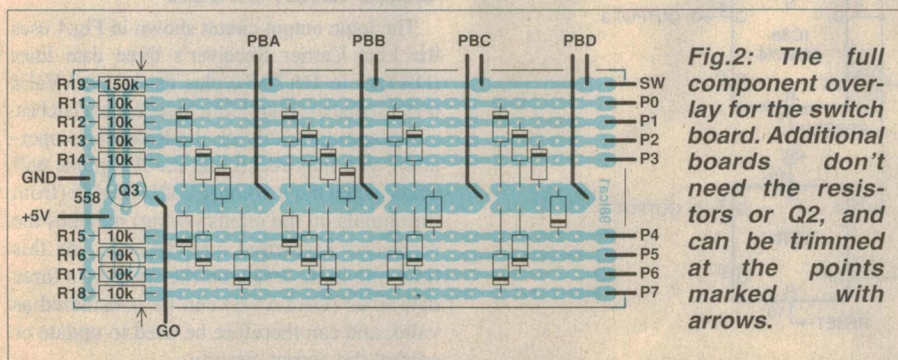


Fig.2: The full component overlay for the switch board. Additional boards *don't* need the resistors or Q2, and can be trimmed at the points marked with arrows.

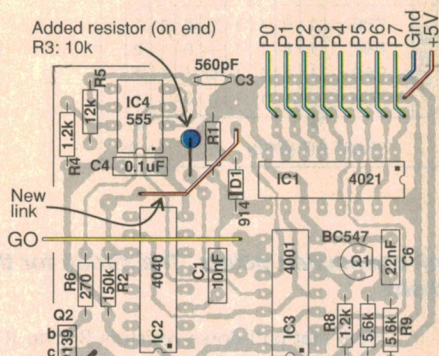
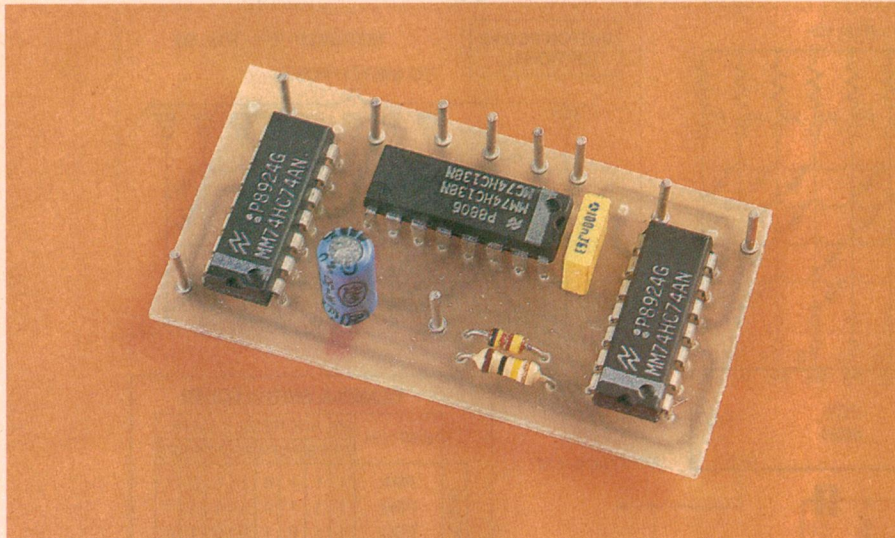
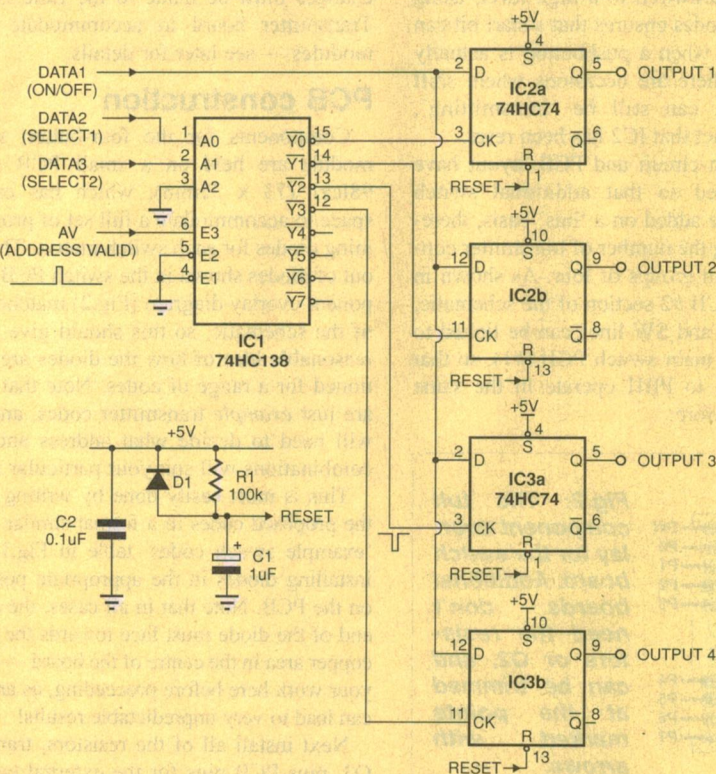


Fig.3 on the left shows the Line Carrier Transmitter's connection points for the switch PCB.

The quad output latch board (pictured above) uses three HCMOS chips to interface the Line Carrier Receiver unit with four independent TTL-level outputs. Its schematic is shown in Fig.4, below.



prototype switch board, we simply flared the legs of the pushbutton switches and soldered them directly to PCB pins. This allows the PCB to be supported by the switches themselves, which in turn can be supported by the transmitter's front panel.

If you decide to fit a further switch PCB, you'll need to connect it to the main switch board (#1) via a length of nine-way ribbon cable (or similar) at the P0 to P7 plus SW points. Note that R11 to R19 plus Q3 should not be fitted on this extra board, and if space is tight, the PCB can be trimmed at the points indicated by arrows on the overlay diagram (Fig.2).

Connecting it up

As mentioned earlier there are a couple of changes that need to be made on the transmitter PCB, before the completed switch PCB can be connected. If you've built up the transmitter as a two-button unit in the same format as our original prototype, you will first need to disconnect the two existing switches, remove the PCB from the box and make the mods outlined below. On the other hand, if you are building up the transmitter from scratch with the four (or more) button system in mind, then just refer to the alternative component overlay (Fig.3) during the construction.

The changes to the existing transmitter board involve first removing all of the programming links at IC1 (eight in all), removing components D2, R3, and C2, then re-installing R3 in place of C2. As shown in Fig.3, R3 (or a replacement 10k resistor) should be installed on end, and a short link fitted as also shown. Note that the circuit then conforms to the transmitter circuit as its shown in the switch board schematic, Fig.1.

Next, the lines from the switch PCB can be connected to the transmitter PCB in the positions indicated in the overlay (Fig.3). These can be just soldered to the copper side of the board, or if you're keen, connected via PCB pins fitted to each connecting point. Other than that, don't forget to connect the 5V supply (+5V and GND), and for a neat result the P0 to P7 lines can be connected using ribbon cable.

Quad latch circuit

The logic output circuit shown in Fig.4 uses the Line Carrier Receiver's three data lines (DATA1 to DATA3), plus its Address Valid (AV) signal to control four independent latches.

Recapping briefly on the Receiver's operation, you may recall that the AV pulse will occur when the incoming address code (from the signals on the mains wiring) matches the receiver's hardwired address code. At this time, the logic levels on the receiver's three data lines (DATA1-3) can be considered as valid, and can therefore be used to update or control the output circuitry.

Here, the DATA2 and DATA3 lines select which output latch will be updated and DATA1 determines its final logic state, while the AV pulse instigates the action.

As you can see from the schematic, the circuit is a fairly simple arrangement based on one 74HC138 3-to-8 line decoder (IC1), plus four D-type latches made up from two 74HC74 dual flipflops (IC2 and IC3). In this case IC1 is only used as a 2-to-4 decoder, where the DATA2 and DATA3 lines (at A0 and A1) are decoded onto the four flipflop clock lines at IC1's Y0 to Y3 outputs.

DATA1 controls the D inputs of all four flipflops, and therefore determines their output state when a clock signal is applied from IC1. Also note that the Receiver unit's AV pulse controls IC1's enable input (E3, at pin 6), so that the flipflops can only be updated (clocked) when the mains-borne command signals have matched the Receiver's address.

In practice then, if the Receiver has decoded (say) a 'latch number three ON' command signal *and* the address condition is satisfied, DATA1 to DATA3 will be set to a code of 101 and the AV line will pulse high. This in turn means that IC1's Y2 output (pin 13) will briefly go low, thereby clocking the high level at IC3a's D input through to its output at pin 5. If the sequence is repeated with DATA1 held *low*, IC3's output will then fall, as you would expect.

The remaining parts of the circuit involve high-frequency bypass capacitor C2, plus the

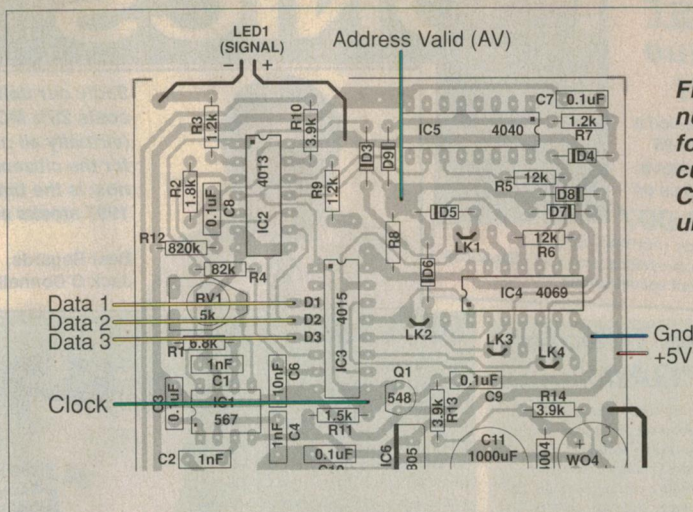


Fig.6: The connection points for the latch circuit on the Line Carrier Receiver unit.

power-on reset circuit based on D1, R1 and C1. Here, the initial low level across C1 will reset all flipflops (at pins 1 and 13) as power is first applied to the circuit.

As there is very little involved in the circuitry for the quad latch output unit, this module is easy to build and results in a compact but useful interface unit. All of the components mount on a small PCB coded 98lcc1 (measuring 54 x 25mm) and should be fitted as shown in its matching component overlay diagram, Fig.5.

The four TTL-level outputs from the latch board can be used for a wide variety of controlling jobs, and the circuitry beyond this point really depends upon the application that you have in mind.

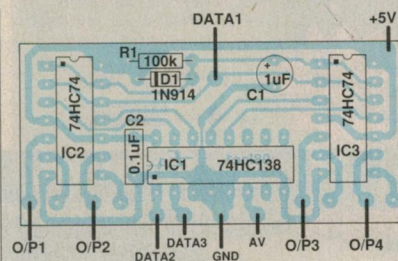


Fig.5: The component overlay diagram for the quad latch PCB, showing all external connections.

Rx changes, connections

To accommodate an alternative output stage such as the quad latch circuit, various signal lines need to be 'tapped off' the Line Carrier Receiver's circuit board, and the existing relay latching circuit disabled. This latter job is not essential by the way, since the relay will just happily click away when the incoming signal codes match the relay output on/off commands.

In passing I should point out that the second article in the December 1997 issue of *Electronics Australia* contained a small error in the parts list and overlay diagram for receiver unit. R15 was shown and listed as 1.2k but should in fact be 120 ohms, as shown in the schematic diagram. This is just the dropper resistor for the relay coil though, so if you are using the quad latch output board instead, a higher value for R15 is of no real consequence...

The quad latch unit's connection points on the receiver board are shown in Fig.6, which represents the upper section of the receiver's layout. PCB pins can be fitted to each of these points if you have the patience; however the quick solution is to just solder the interconnecting leads to the correct pads on the *copper* side of the receiver's PCB.

In the fourth of these articles I'll describe a module which connects to the Line Carrier Receiver to implement a two-channel 240V AC lamp dimmer. ♦

PARTS LIST Four-way switch board

Resistors

R11-18 10k
R19 150k

Semiconductors

Q3 BC558
Diodes approx 30 x 1N914, as required

Miscellaneous

PBA-D SPST pushbutton switches
PCB coded 98lca1, optional ribbon cable & PCB pins

Quad output latch

Resistors

R1 100k

Capacitors

C1 1uF 16VW electrolytic
C2 0.1uF monolithic or MKT

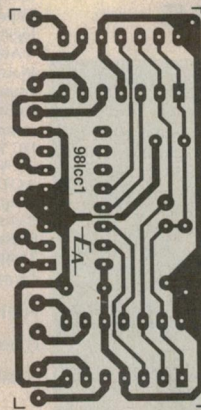
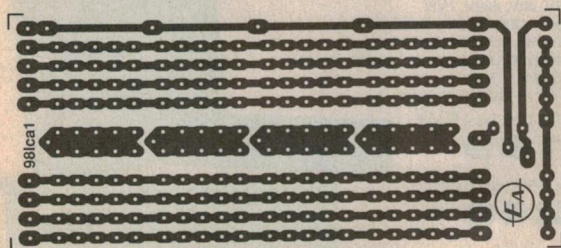
Semiconductors

IC1 74HC138 3-to-8 decoder
IC2,3 74HC74 dual D-type flipflop
D1 1N914 diode

Miscellaneous

PCB coded 98lcc1, PCB pins.

The actual size PCB artwork for the quad latch board (right) and the four-way switch board (below).

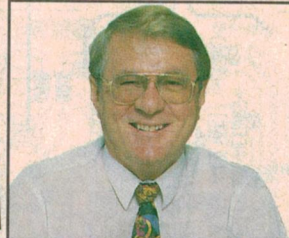
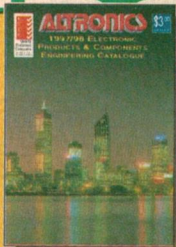


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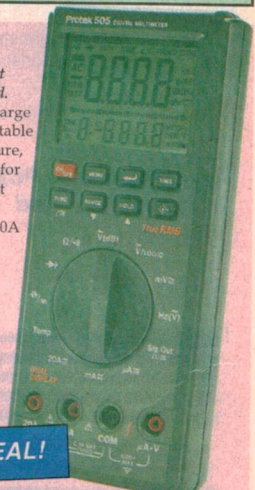
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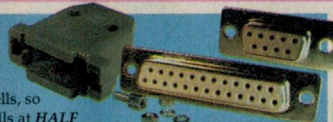
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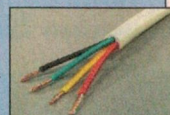
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Batteries, chargers and dischargers — 2

This month, we continue our look at batteries, charging circuits and discharging circuits. We go through some circuits and examine some timely issues about memory effects — plus the way to charge sealed lead-acid or 'SLA' batteries (but *not* using a fancy dedicated chip).

Last time, you'll remember we looked at some very basic NiCad battery chargers and a NiCad Zapper circuit, designed to fix dead cells.

The memory effect is the greatest plague that inflicts NiCad cells and while the NiCad Zapper is designed to fix the problem that occurs within the cell, as always, an ounce of prevention is better than a tonne of cure.

The memory effect in NiCads is caused by dendrites forming between anode and cathode of the cell, shorting it out. In extreme cases, the cell simply won't charge or run any appliance for more than a few seconds.

As I mentioned before, prevention is the key and the prevention is always making sure that your NiCad batteries are discharged before you begin to recharge them.

Now the end point of discharge is like most things a point of discussion. The point I use is when the cell reaches 1.0V, under a standard load consuming one-tenth of the battery capacity.

For example, if the cell has a capacity of 500mAH (milliamp-hours), then the test load current should be 50mA.

Problem is that it's not always convenient to run down a battery to that end point. Take for example the case where you need to have a full set of batteries in your notetaker to record a lecture, but you only have enough battery-life left for half that.

Of course, you could go and buy some 'throw-aways', but it sort of defeats the purpose a bit, doesn't it?

NiCad Discharger

Our first circuit provides a handy mechanism of draining cells to the correct point and then switching off.

There have been a number of these circuits published in the past, but they've used exotic components to do the job. Special thermal-tracking current source ICs sound all well and good, but they're definitely

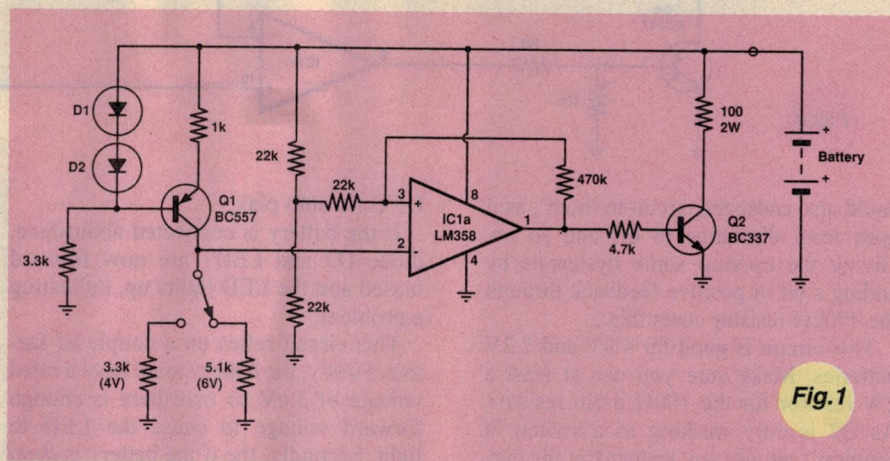


Fig.1

overkill. I much prefer to keep things simple and worry about the exact science of batteries some time down the track.

The circuit in Fig.1 uses a simple current source from the first part in our battery series. We know that if we feed a constant current through a resistor, we develop a constant voltage. To allow for a number of different cells, we have to adjust that constant voltage and use it as a reference point.

As you can see, the bulk of the circuit is based around IC1a, half of an LM358 op-amp IC.

Now in order for this circuit to work, we've had to make the reference voltage half of the desired battery shut-off voltage.

Here's how it works. If we have a four-cell battery, the battery voltage we want the discharger to shut down on is 4V, that is, 1V per cell. Our current source can't work at what would have been the supply voltage so we select the reference voltage to be half that — that is, 2V.

Same goes for a six-cell pack. The voltage we want the circuit to drop out on is 6V and thanks to the divider circuit, the reference point is 3V.

These are the voltages that appear at the output of the current source section of the circuit at the collector of transistor Q1.

Depending on the switch setting, the circuit develops a specific reference voltage thanks to the current source.

While ever the battery voltage remains above the reference voltage, the output of the op-amp is high. This ensures that transistor Q2 is on and draining the battery. Once the voltage drops slightly below the reference voltage, IC1a's output drops low and the transistor switches off.

What's likely to happen though is that the battery voltage will rise slightly once the load has been disconnected. This

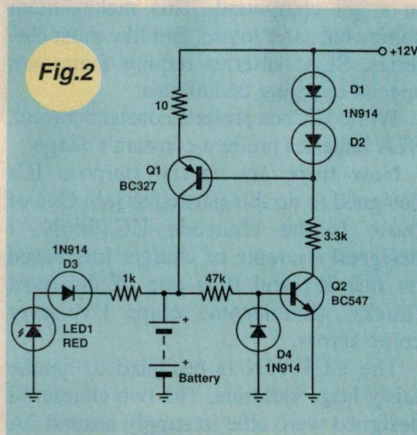


Fig.2

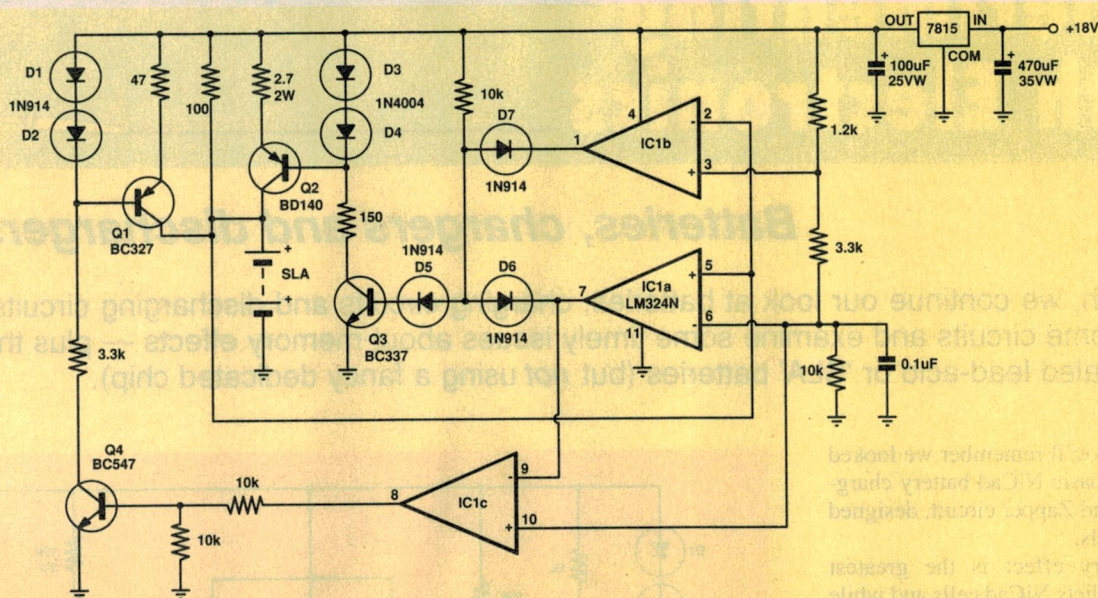


Fig.4

could also cause the circuit to 'hunt', as it goes from discharge to off and so on. Giving the op-amp some hysteresis by adding a bit of positive feedback through the 470kΩ resistor cures this.

This circuit is good for 4.8V and 7.2V batteries. Make sure you use at least a 2W resistor for the 100Ω drain resistor. As Q2 is only working as a switch, it shouldn't require any heatsink at the current levels it will see.

NiCad Charger No.4

While NiCad batteries don't handle memory effect too well, they also don't enjoy being connected up to a charging circuit the wrong way round. This next charger circuit has enough brains to shut down should the battery be connected backwards.

Again, it uses a current source as its basis — but it has an interesting twist, in that the battery itself becomes part of the control circuitry.

Looking at Fig.2, transistor Q1, its 10Ω emitter resistor plus 1N914 diodes D1 and D2 form our crude but effective current source. With a forward voltage of 1.2V generated by the diodes, the 10Ω resistor develops 0.6V, giving about 60mA of charge current.

But the current source only works if transistor Q2 is switched on, to provide current for the diodes and Q1's base. With the battery connected correctly, this happens automatically.

But if the battery is connected back-to-front, the battery voltage forces Q2 off. And with Q2 off, transistor Q1 doesn't turn on and withholds current from the battery. This is where LED1 and diode

D3 come into play.

If the battery is connected about-face, diode D3 and LED1 are now forward biased and the LED lights up, indicating a problem.

This circuit relies on a couple of factors. Firstly, the battery must have a rated voltage of 3.6V so that there is enough forward voltage to cause the LED to light. Secondly, the if the battery is *dead* flat, it won't work.

Depending on your battery, you may need to change the current-limiting resistor in series with D3. For 6V packs and lower, use a 330Ω resistor. Above 6V, use a 1kΩ resistor.

It's not perfect, but it will at least give you warning before any real damage occurs.

SLA batteries

A increasingly popular choice for portable power is the Sealed Lead Acid (SLA) battery. Instead of adding water to them regularly, they're sealed using acid in a gel compound. This makes them somewhat safer to use. But like most batteries, SLA batteries require their own special charging techniques.

While NiCads prefer a constant current, SLA batteries prefer a constant voltage.

Now there are special purpose ICs designed to do this particular job. One of those is the Unitrode UC3906N. I designed a couple of charger kits based on this IC, and it is one of the most finicky, troublesome chips I've ever come across.

The UC3906N is designed to handle fairly large batteries. The two chargers I designed were able to supply around 3A

of current when flat out. For you 'older heads' that may not sound like much, but for this particularly column, it presents some new issues.

Going back to the SLA batteries, there's plenty of literature which suggests that the best way to charge up an SLA battery is to do it in three stages — all based on a single reference voltage of 2.3V. This is the nominal voltage you'll get from a single cell in an SLA battery.

If a 12V battery is below 10.8V, you should give it a trickle charge equal to about 1% of its ampere-hour rating. For example, if a battery is rated at 1.2Ah, the trickle charge should be 12mA.

Between 10.8V and 13.8V, the battery can be charged at the main charge rate which should be no more than 25% of battery capacity. In our example, that would be 300mA.

Once the battery voltage hits 13.8V, the current should drop back to a holding charge current, which decreases as the battery rises to 14.6V.

Rather than use a fancy chip to do all of this, here's a no-frills solution.

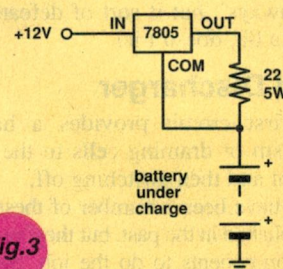


Fig.3

SLA Charger No.1

Now I have to admit that this is more of a circuit design rather than a fully-tested circuit, but it should work. Each of the individual sections we've used before, and this circuit is pretty much just adding them together in a specific way. In the end, that's what circuit design is pretty much all about.

The circuits I'm presenting to you here are not just for you to copy, but so that you can work out your own designs and build your own electronics projects. I think it's much more fun building my own circuits rather than someone else's...

This particular circuit, shown in Fig.3, is built around an LM324 quad op-amp IC and two current sources acting as the main charging elements.

It has three main operating modes: trickle charge, main charge and top-up charge.

Trickle charge: If the connected battery is less than 10.8V, IC1a's output is low since its non-inverting input is lower than the inverting input. The output is then inverted by IC1c and this is used to drive the current source built around transistors Q1 and Q4. This sets the trickle charge current 'It' to 12mA. Note that during this time, IC1b's output is high since its non-inverting input is sitting at 13.8V.

The outputs of both IC1a and IC1b are connected to control transistor Q3 in the main charge circuit, via a diode AND gate (D6, D7, D5). This gate's purpose is to ensure that the main charge circuit operates only when both outputs from IC1a and IC1b are high. This corresponds to when the battery voltage is between 10.8 and 13.8V.

Main charge: When the battery voltage reaches 10.8V, IC1a's output goes high, switching IC1c's output low and turning off the trickle current circuit. Note that IC1b's output is also still high, because the battery voltage is less than 13.8V. The diode AND gate then enables the main charge circuit, built around transistors Q2

and Q3. The charge current here is 240mA.

Note that transistor Q2 should have a heatsink. The current source diodes D3 and D4 are now 1N4004 rectifier types. These devices can handle up to 1A — I'm not convinced that 1N914's would be reliable enough, even though the current here is still within their specification.

Top-up charge: When the battery voltage hits 13.8V, IC1b's output now falls low and with IC1c's output also low at this stage, neither charge circuit is in operation. The battery continues its top-up charge thanks to the 100Ω resistor connected directly to the battery. As the battery's voltage rises to 15V, the holding current drops down to zero.

As I said before, it's as crude as you can get, and as it stands the circuit will work best with 12V/1.2Ah batteries. It will indeed charge higher capacity batteries — you'll just have to wait proportionally longer for them to completely charge.

The circuit also contains no LED indication. This wouldn't be hard to add in using the spare LM324 op-amp left over, but I'll leave that for you to experiment with.

NiCad Charger No.5

One problem which often rolls around is that of charging NiCads from a car battery. And this is something that's becoming more common, as more and more equipment is being used 'on the road'.

This next circuit I can't take credit for, but it's well worth keeping in your circuit notebook. Again, it's crude, rather clever and very quick to throw together.

In reality, it's nothing more than a simple current source — but the thing I like about it is that it uses just two common components, and one of them is a resistor.

The circuit for our NiCad Charger No.5 is shown in Fig.4. Obviously, the clever bit is in the use of the 7805 regulator IC. We've used this component before, but never in this configuration.

The 7805 is designed so that its output

pin delivers a voltage of 5V with reference to its ground pin. In this circuit, both these pins are connected across a 22Ω/5W resistor. Since we now have a constant voltage across a resistor, the current through that resistor must also be constant.

This circuit will deliver a little less than 250mA into a battery. Since we're now in the area of 'rapid charging', it's important to keep an eye on the charging time. You must also make sure the battery is capable of being rapid-charged to begin with. I'm not offering any warranties, so take this as a warning: batteries not designed to handle a high-speed charge could well blow up on you.

The problem with this circuit is that you can only really charge two NiCad cells at a time. The 7805 needs a voltage differential (input to output) of around 7.5V to work properly, so with a car battery at 12V, that leaves us with around 4.5V to play with. So in an emergency, you could use it to charge three cells at once.

The 7805 will also need plenty of heatsinking to dissipate some of the heat. I wouldn't put this circuit inside a plastic case — a diecast box would be better.

OK, that's enough battery charger circuits. Next month, we'll start a new topic as we continue experimenting with electronics. See you then, I hope. ♦

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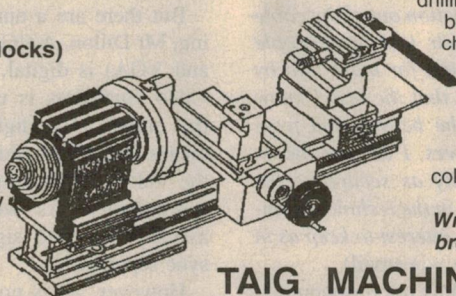
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INFORMATION CENTRE

by PETER PHILLIPS

Sputnik replicas, project enquiries & static electricity

There's quite a few letters about projects and circuits in this month's column. There's also enquiries about making a CGA monitor into a TV set, and ways of dealing with nylon carpet that causes static electricity.

Last November I witnessed a simple but memorable event you might not have heard about: the 40th anniversary of Sputnik, the first man-made satellite. I vaguely remember the excitement in 1957 when Russia launched this satellite, thereby becoming the leader in the space race.

To commemorate the event, a group of students in the US has built a replica of Sputnik, which was launched in 1997 by the crew of a space shuttle on its way to the Russian space station. The satellite even transmits the same sound as the original: 'beep-beep-beep-beep' etc, from an onboard 100mW FM transmitter at (I think) 140MHz.

The satellite orbits the Earth 15 times every 24 hours at an altitude of around 340km, roughly following the same orbit as the Russian space station. Anyone with a portable FM multiband receiver, a TV antenna and a computer program that tracks satellites can listen in and hear the transmitted beeps when the satellite is in range. For the demonstration I attended, this lasted about five minutes.

The guy who set up the demonstration went on to explain why Russia lost its lead in the space race. I can't verify (or deny) his story, but it's interesting nonetheless. According to the story, at the time there was only one scientist in Russia who knew how to make a rocket take off without dancing across the ground during launch, something no other country could do; but then this guy got appendicitis. Because of his importance, it was decided to take no risks and to ask the Russian Minister for Health (no less) to operate on the scientist.

Bad choice! The scientist died, and Russia lost the lead to America...

If you're interested in tracking the Sputnik replica, you can download satellite tracking software from the Internet. Then when the satellite is over that part of the country where you live, point the antenna (connected to an FM receiver) at the satellite and listen in. It's that simple.

And as you listen in, you'll probably

ruminate on the technological advances that have made it possible for anyone to track and listen in to a satellite — something most people 40 years ago would have thought impossible.

Now let's turn to reader letters. Here's the first, which deals with a topic we started a few issues ago.

Pay TV quality

You might recall I discussed the relatively poor picture quality of cable TV in the November 1997 issue. This letter makes a few interesting points about pay TV in general...

Many of us have heard stories about the guy with a perfect pay TV picture, and others with pretty shabby pictures. The reason is that cable companies are all running analog systems in Australia, so it depends on how many amplifiers there are between the fibre node and your place as to how much noise has been added, and so how good or otherwise your picture is. When they eventually go digital, such problems will disappear.

But I wouldn't hold my breath for that, considering the financial state of our cable industry. We currently have the first digital pay TV service in the world in the form of the Galaxy and Austar digital satellite service. The picture quality from this service (not to be confused with their analog microwave services) is outstanding.

As to getting information out of the cable companies, one of their technical people responded to my request for more info by telling me to my face that the less I know about their system, the better! And from what I hear from others, I am not alone. Their systems are only as secure as the lack of understanding in the technical community, so it's in their interest to keep us in the dark. (Peter Lacey, via email)

Information is certainly not forthcoming, is it Peter? Regarding the use of analog technology, I found this out a few weeks ago when a Telstra technician came to my

house to fix my Foxtel set-top box. According to the technician, cable companies have used old technology to get pay TV up and running as quickly as possible.

According to another source, the major pay TV players believe that the public doesn't want quality digital pictures — it just wants sport, sport, sport. So our chances of getting more digital in the near future are probably pretty slim.

Unfortunately, while Galaxy's satellite service delivers much better quality transmissions, it doesn't include the off-air stations, which for many people is a big reason for getting pay TV. So, it doesn't look good for us videophiles who expect more than the cable companies are prepared to offer.

TV from a CGA monitor

The next letter is from a reader who wants to convert a CGA monitor into a conventional TV set:

I have a CGA monitor which has inputs for red, green, blue, intensity, video, vertical sync and horizontal sync. I also have a tuner from a VCR. Could you please suggest how I could convert the monitor into a TV set. (G. Dillon, Pascoe Vale, Vic)

On the face of it, a CGA monitor seems like an ideal candidate for conversion to a conventional TV set. After all, unlike EGA and VGA monitors, it has the virtually the same horizontal and vertical scan frequencies as those in a TV set.

But there are a number of stages missing, Mr Dillon. A CGA monitor (like EGA and VGA) is digital, so the signal to the video amplifiers is usually straight from the output of a digital logic gate. This means there's no video preamplifier, and the video output stage is probably quite rudimentary. As well, the sync input assumes separate signals, so there's no sync separator.

However, all is not lost. I suggest that you might indeed be able to make a CGA monitor into a TV set, but you'll need a lot more than just a tuner. In fact, you'll need

all the circuitry from a TV set that takes the output from the tuner and produces the RGB video signals, the separate sync signals and, of course, sound.

This sounds a lot, but with a bit of scavenging, you might find the front end of a TV set that can be adapted. Good luck, if you'd like to try — there's a bit of work in it.

Simple sampler

One of our more popular projects has been the Pocket Sampler (August 1996), with reports of hundreds of kits having been sold. But if you are after a simpler and therefore cheaper version, you might try the Simple Sampler presented in our Circuit & Design Ideas section in the September 1997 issue. The following letter has a few questions about this circuit, which is shown in Fig.1 (with a few additions as explained after the letter).

I have a number of questions about Juan Akkad's sampler circuit in EA September 1997. The circuit doesn't show what type of diode to use, but as they simply direct power to the LM311, can I use 1N4148 diodes rather than power diodes like the 1N4004?

Secondly, as the circuit has an R-2R ladder as a digital to analog converter, there's a chance it could be used in 'playback' mode, to convert digitised samples from the printer port to analog voltages. However, I assume the printer port on the computer can't supply enough power to drive a speaker to play audio samples, so what sort of amplifier would I need? Could I use a basic one or two transistor circuit, or perhaps an LM386? Could this amplifier be run from say 9V, without upsetting the 5V supply from the computer?

The R-2R network uses 15k and 30k resistors, but are these values critical? And how do you calculate the two values such a converter requires? As 30k is not in the E12 resistor series, would 27k work just as well in this application? (Peter Fox, Broken Hill, NSW)

Yes, Peter, you can certainly use 1N4148 diodes for all the diodes in the circuit, as they only supply current for the LM311. These diodes can pass up to 100mA, which is far more than is needed by the LM311.

To amplify the output of the R-2R network, you'll need a high impedance buffer stage to interface between the output of the network and the input of any audio amplifier. The LM386 has a low input impedance of 50k, which would load the network and seriously affect its output. I suggest using an op-amp non inverting amplifier, which can then drive an LM386 or any audio amplifier you want. This is shown on the circuit in Fig.1.

And yes, you can operate it from a separate supply, although the negative terminal of the extra supply must be connected to

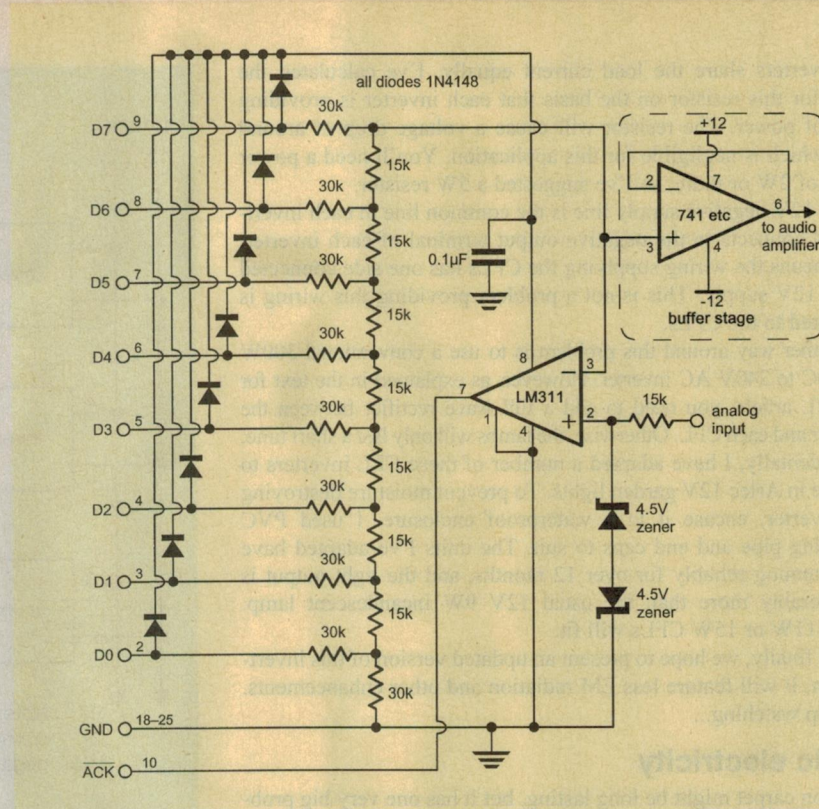


Fig.1: This circuit is from our September 1997 Circuit & Design Ideas section. A reader hopes to use it 'in reverse', in which the printer port presents digital sound to the circuit, which is converted to analog by the R-2R network. The added buffer stage allows the output of the network to drive an audio amplifier.

the negative supply for the sampler circuit. You might consider using the computer's power supply for this. The buffer stage I've mentioned needs a dual polarity power supply, so you could use the +12V and -12V supplies for this, and the +12V for the audio amplifier. These supplies are already relative to the same common line as the +5V supply. Incidentally, if you want to improve the linearity by reducing the loading on the printer port, power the LM311 directly from the +5V supply in the computer and remove all the diodes.

An R-2R network by its very definition needs resistors that differ by a ratio of 2:1. So no, you can't substitute a 27k value for the 30k resistors, as this will affect the linearity of the network. However, the actual resistor values are not critical, providing the 2:1 relationship is maintained. The values are usually chosen to suit an application, and take into account the loading on the circuit (in this case the input of the LM311), and also the load the circuit imposes on the source (the printer port).

A popular way to get the 2R value is to use two R values in series. So for this circuit you'd need 26 15k resistors. Or if you have lots of say 10k resistors, use them by substituting a 10k for each 15k, and two 10k resistors in series for the 20k value that replaces the 30k resistors in the circuit.

CFL inverter

Another very popular project (based on kit sales) is the CFL and Fluoro lamp inverter in the June 1995 issue. I'll have more to say about this project after the next letter, which asks a few questions about modifying the circuit.

I'm writing in reference to the CFL inverter on page 60, June 1995. The inverter is limited to a 40W load, but can these units be connected in parallel (at the 12V and 350V sides) to drive a 200W load? This would give a single unit inverter that could be connected to the lighting circuit of the house, rather than having four or five separate units.

If this is not possible, I suggest you might consider a higher power version of this project. I'm sure it would be popular with the many people who produce their own electric power for remote locations. An automatic start function would be useful! (Richard Morgans, Mulgrave, Vic)

While I can't be sure, Richard, as I don't have two or more inverters to try it, I think you might be able to connect them in parallel. The circuit I'm suggesting is in Fig.2. Basically, each inverter can be regarded as a 350V DC battery.

To connect them in parallel, you need a diode to prevent one inverter 'charging' another, and a series resistor to help ensure

the inverters share the load current equally. I've calculated the value for this resistor on the basis that each inverter is providing 40W of power. The resistor will cause a voltage drop of around 11V, which is negligible for this application. You'll need a power rating of 2W or more, so I've suggested a 5W resistor.

The 12V negative supply line is the common line in each inverter, and connects to the negative output terminal of each inverter. This means the wiring supplying the CFLs has one side connected to the 12V supply. This is not a problem providing this wiring is dedicated to the CFLs.

Another way around this problem is to use a conventional 300W 12V DC to 240V AC inverter. However, as explained in the text for the CFL article, you need to add a full wave rectifier between the inverter and each CFL. Otherwise, the lamps will only last a short time.

Incidentally, I have adapted a number of these CFL inverters to operate in Arlec 12V garden lights. To prevent moisture destroying the inverter, encase it in a waterproof enclosure. I used PVC plumbing pipe and end caps to suit. The units I've adapted have been running reliably for over 12 months, and the light output is considerably more than the usual 12V 9W incandescent lamp. Either 11W or 15W CFLs will fit.

And finally, we hope to present an updated version of this inverter soon. It will feature less EM radiation and other enhancements. So keep watching...

Static electricity

Nylon carpet might be long lasting, but it has one very big problem: static electricity. The next letter is from a reader who is even concerned about his health, because of the shocks he continually gets from the carpet in his workplace...

At work I receive shocks with visible white flashes when I touch metal fixtures and equipment in the building. I handle delicate static sensitive computer hardware and integrated circuits. The building has cement walls and floors covered with nylon carpet. The shocks occur throughout the building.

I wear an antistatic footstrap and have even tried taking off one shoe, but the problem remains. Should I be worried about myself in regard to the excess ions I'm attracting? Is there anything that can be done about the problem? (Paul Vierkant, via BBS)

I believe there are antistatic products available that you spray on the carpet Paul, but I don't know how effective they are. As for an antistatic footstrap, this will only work if one end is earthed, so I don't think it's a solution to the problem.

You might have noticed that the problem is less severe in high humidity conditions, such as when it rains. One method I've heard of that allegedly reduces static electricity from carpet is to humidify the air, perhaps from an evaporative type cooling system. You might therefore try damping the carpet a little to see if it helps. If so, speak to your boss about getting a humidifier system.

I don't think your health will directly suffer from too many ions, but your nerves are probably always on edge. As well, the equipment and ICs you are handling will certainly be damaged if you happen to touch them in the wrong place.

Perhaps other readers might have a few suggestions. It's a real problem for many people, so I'll look forward to any suggestions that might solve it.

Touch lamp noise

In the September issue, I described the operating principles of a typical bedside touch lamp. But several readers have reminded me that I didn't talk about the electrical noise these lights produce...

I read with interest your comments about the operation of a touch activated lamp. It so happens that a family member uses such a lamp in a bedroom, but it radiates a great deal of electrical noise, which is

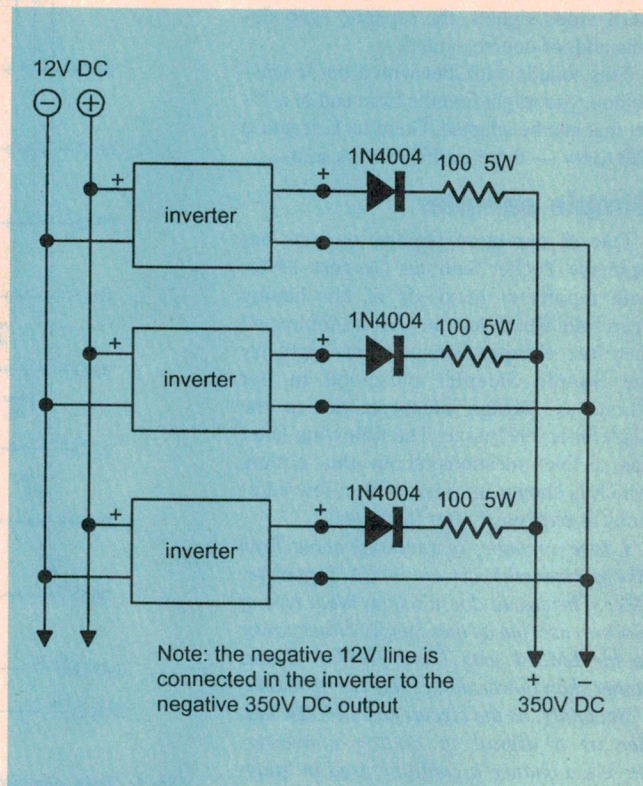


Fig.2: This diagram shows a suggested (and untried) method of connecting CFL inverters in parallel to give a higher output power.

picked up by a nearby radio. I have tried various ways of suppressing the noise, but have ended up disconnecting the lamp. Do you know of any method that will get rid of the noise? (G.P., no address)

The EMI you're experiencing is caused by the sharp rise in current that occurs every time the lamp's triac switches on. A properly designed triac circuit will have various filters, such as an RC or snubber network across the triac, and an LC (inductance and capacitance) network between the triac and its load. Here the inductor slows the rate of rise of the current, which in turn reduces the EM radiation.

To achieve this you could experiment by connecting an inductor in series with the lamp. To make the inductor, wind about 30 turns of suitable gauge winding wire on a piece of ferrite rod (or better still, a ferrite toroid). A small (say 0.1uF) mains rated capacitor (250V AC) connected across the lamp might also help.

What??

Now here's a simple question, that doesn't need any maths. It comes from David Timmins, of Mascot NSW, who asks:

A person is sitting in a boat, which also contains a large heavy rock. What happens to the net level of the lake if the person throws the rock overboard. Does it rise, fall or stay the same?

Answer to January's What

Starting with terminal B, because $R3 = R4$, the voltage at the non-inverting input is 1V. Therefore the voltage at the inverting input is also 1V. Because there's 1V at both ends of $R1$, no current flows (as there's no voltage drop across $R1$). Therefore the impedance looking into terminal A is infinite (assuming a perfect op-amp). The impedance looking into terminal B must be $R3 + R4$ as there's 1V across both resistors. That is, the full 2V at terminal B appears across both resistors in series. ♦

UPSONIC'S MI-300B

The smallest member of Upsonic's new 'PC Power-Ups' series of uninterruptible power supplies for PCs, the MI-300B has a rating of 300VA and offers features such as automatic mains voltage regulation and 'fully intelligent' RS-232C communications. At the same time it's only about the size of a loaf of bread, and has an attractively low price.

by JIM ROWE

Regular readers will recall that back in the November 1997 issue, I reviewed the PS-MS300 'Personal Series' uninterruptible power supply from Upsonic. Although very compact indeed (only 187 x 173 x 103mm), that unit proved capable of keeping a fairly elaborate 133MHz Pentium system running happily for over 15 minutes following a power failure. Very impressive performance for such a tiny unit, and presumably the result of using the latest high-efficiency inverter circuitry.

It turns out that Upsonic has now released an even newer range of UPS's, the PC Power-Ups series, which although not quite as compact offers a number of additional features. These include automatic voltage regulation (buck/boost) in normal from-mains operation, what's described as a 'fully intelligent' RS-232C interface, higher conversion efficiency and a 'cold start' function. They also come bundled with the SmartMon software, which is an optional extra with the Personal Series.

Like the models in the Personal Series, the PC Power-Ups are basically 'standby/line interactive' UPS's, meaning that they keep the battery charged and the DC/AC inverter running at the time, ready to be switched in to replace the mains supply if there's a blackout or severe over/under voltage situation. According to the Upsonic specs, they make this switchover in less than 5ms for a blackout and less than 3ms for under/over voltage — i.e., in less than a quarter of a mains cycle in both cases. This is more than fast enough for modern PCs and their peripherals 'not to notice', of course.

The PCP-MI300B shown is again the smallest in the PC Power-Ups range, with a power rating of 300VA (180W). It measures 258 x 119 x 98mm, so it's not quite as compact as the PS-MS300. The weight is also a little more (6kg vs 4.5kg), which is mildly surprising considering it uses a 12V/4.5 ampere-hour battery rather than the 12V/7AH unit used in the PS-MS300. As a result the rated hold-up time with a typical PC system load is a little shorter (10 minutes vs 15min), despite the higher inverter efficiency (94% vs 88%).

The PCP-MI300B can cope with an input voltage range of 170 - 270V, and in on-line mode delivers a regulated 220V providing the mains remains within the range 193 - 246V. It can cope with an input frequency in the range 45 - 65Hz, meaning that it can run from emergency generators if necessary. Normally it automatically selects and matches the two most standard supply frequencies of 50Hz and 60Hz.

As part of the 'fully intelligent' features of the PC Power-Ups series, it has an RS-232C serial port via a DB-9 connector, and provides status lines indicating power failure (battery operation) and low battery charge. The computer can also instruct the UPS to shut down after 20 seconds, to conserve battery charge. (Normally this would be after the software has performed a data backup.)

All power connections to the PCP-MI300B are via IEC connectors. There's the usual captive plug for input, and two sockets for outputs. The input connector has a pull-out fuseholder with a compartment for a spare fuse — very handy!

There are only three indicator LEDs with this model, marked LINE,



BATT and FAULT — plus a TEST button. However all three LEDs perform double functions, depending on whether they're lit continuously or flashing, and the button is also used to turn the UPS on and off as well as perform self-checking.

Trying it out

We tried out the sample PCP-MI300B with a couple of different PC systems, including the 133MHz Pentium system used for the PS-MS300 tests. In each case it provided smooth and transparent

changeover when we created a virtual 'blackout', and ran the systems for between 4.5 and seven minutes before the inbuilt beeper indicated that the battery was nearing the end of its charge. (Needless to say we'd allowed it to charge up again, each time.)

While this holdup time is certainly not as long as the 15-plus minutes provided by the PS-MS300, it's still likely to be more than enough for most users (or server backup systems) to back up their most crucial data and 'back out' before turnoff.

Considering that the PCP-MI300B offers the auto voltage regulation feature, and comes bundled already with the SmartMon software (Win 3.X, Win 95, NT or Novell versions available), for an RRP of only \$358, it therefore seems good value for money.

Incidentally it's also available with factory-fitted telephone line surge protection ports for modem protection, for an RRP of \$392. And of course there are both higher-capacity UPS models in the PC Power-Ups range, as well as many other Upsonic UPS's — including models with true sinewave output and true on-line double conversion technology. You'll find more details on their Web site at <http://www.upsonic-power.com.au>. ♦

Upsonic PCP-MI300B UPS

Compact 'intelligent' standby UPS for PCs, with a rating of 300VA and automatic voltage regulation.

Good Points: Very fast 'transparent' changeover, high efficiency (94%), holdup time should be sufficient to allow saving of crucial data in the event of a power failure or brownout, in most cases. RS-232C serial port for automatic software control.

Bad Points: Nothing significant.

RRP: \$358 including SmartMon software for most PCs.

Available: From computer dealers. For further information contact Upsonic Power Pty Ltd, Unit 1, Block C Slough Business Park, Janine Street, Scoresby 3179; phone 1800 634 307 or fax 1800 634 308.

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Moffat's Madhouse...

by TOM MOFFAT



Perfect Computer: The Sequel

"I bet you opened a can very full of worms..."

So said one reader, in response to November's Madhouse column titled 'Let's Build the Perfect Computer'. And he was dead right. A 44-gallon drum full of worms, in fact.

Of course I did question all the common wisdom in today's computer industry — big fast powerful machines, blazing CPU speeds, enormous hard drives, bells and whistles galore, the latest of everything; and worst of all, whether we really need Windows.

Then I started making suggestions about what I thought would make the ideal computer. Just to recap, I said it should be a 'workhorse' as opposed to a glitzy plaything; it should be a traditional IBM-PC, a tried and proven design; it should be a laptop, as opposed to a desktop; and it should use a conservative microprocessor, instead of a speed demon, hopefully of CMOS design for low power drain and heat generation.

It would be nice if the screen would show good colour, although without the need for a backlight. Backlit screens are useless outdoors where a laptop should thrive, and they draw lots of power. And the ideal computer should have a top-quality keyboard, full-sized and suitable for the fastest touch-typist.

Following that little bit of pump priming, we opened the subject for reader input, via e-mail. Many people took a lot of time and effort to write very thoughtful letters, both supporting the 'small computer' idea and strongly supporting the status quo of big, powerful machines running Windows. In most cases, each side seemed to respect the other side's views. So it seems there is a place in this techno-world for both kinds of computers, small and large, depending on who is using them, and for what purpose. I carefully picked through every e-mail message, keeping a tally sheet of who wanted what features. Keep in mind that

this is not a statistically correct survey, though, because the people sampled were not randomly selected. They were the ones who felt strongly enough either way to sit down and compose a response to the article. But what they came up with does make interesting reading.

Most wanted features

Here, then, in order of decreasing frequency, are what *you*, the readers who responded, want in a perfect computer. This doesn't mean that people who didn't mention certain features don't want those features, it means they only listed those things that particularly interested them:

Notebook style, with reflective colour LCD screen (69%): Nobody specifically suggested that backlighting should be retained. My own view is that it would be nice to have one screen that would work both ways. In November I questioned whether this is possible, and one correspondent says it is — as evidenced by a toy video game...

The Atari (may it rest in peace) Lynx used a reflective LCD screen. The problem with reflective colour screens is that they have very poor viewing angles and are NOT viewable in room light. The Lynx had a button to turn backlighting on or off for indoor/outdoor use.

So Mr Laptop Manufacturer, there's a good starting point.

A viable alternative to Windows (62%): This subject became a little emotional. Here are some of the e-mail comments...
^%\$#*& Windows, Bloody Computers.

I also dislike Windows, with Windows 95 an even bigger dislike than Win 3.1.

Windows is just a high graphics display menu system — a waste of time!

The perfect unit will be without Windows' style of bloated operating system tack-ons. The dreaded blue screen of death is not needed by me, nor many others to do their work efficiently and effectively.

The dreaded blue screen of death.

How nicely put! We've all seen that from time to time, labelled 'Exception Error' or similar. And then you kiss your data goodbye.

Now to the other side of the coin. Here's an excerpt from another e-mail:

Just because you are using old text editors to do your work bears no relation to what the average user needs. But be honest with yourself: have you not sometimes wanted to import a graphic or a spreadsheet into your text, eh? Sure cut and paste physically for a monthly column is OK, but with me & my kit descriptions I can import the Protel schematic, graphics & tables with no effort. I can have all of them on the screen in windows simultaneously — its called multitasking. And changing any of them automatically updates the main Word document. Microsoft programs are popular because they work & fill the needs of the average & advanced user. You are a below average user.

Just a couple of quick comments here... the 'old text editor' I'm using was released on Jan 2, 1997. It is indeed an MS-DOS product, and a damned fine one too. This entire column this month is cut-and-pasted like crazy, electronically ripping stuff out of a Eudora mailbox file and inserting it here. Yes, I guess I am a below average user, but a contented one...

Here is a very thoughtful response from a reader who likes to use Windows, is comfortable using Windows, but who drops into DOS when the situation warrants. He is one of the reasons why Windows and non-Windows computers should be allowed to co-exist:

I like using Windows 95 for the following reasons:

- *I like to be able to use a small text font so I can see lots of text on my screen at once. Writing/debugging programs with 25 lines of text is awful.*
- *I like to be able to buy software and know that I will be able to print to my Laserjet regardless of whether the*

programmers have written a software driver for it.

- *I like to be able to download a circuit board file to the company that makes them for us, and still be able to use my computer. Same for the Internet.*
- *I like to be able to dynamically resize/reposition information windows as their importance dictates.*
- *I like to be able to launch programs without having to remember what the launch executable is called, or for that matter where it is.*
- *I like to have long filenames so that I can incorporate revision numbers in the filename, and still be able to understand exactly what the file is without having to open it.*
- *I like to be able to use DOS when I feel like it. I use it for file management.*
- *I like to be able to kill off applications that have crashed, without necessarily having to reboot my machine.*
- *I like to be able to produce manuals that don't look like they were printed using a teletype machine.*
- *I like to be able to cut from say an email and paste it into a word processor document.*

Windows alternatives?

So what are the preferred alternatives to Windows? This brought some unexpected responses. My thinking has been, if it ain't Windows then it's gotta be MS-DOS. And this is the position of 46% of respondents. But some interesting alternatives are mentioned.

One is Linux, a version of the Unix operating system tailored for the small IBM-PC. Unix is industrial-strength stuff; your Internet service provider's system is probably Unix based. I have never messed with Linux, but I'm getting interested. I'm thinking of converting my old Toshiba laptop over to Linux for a while, just to get the feel of it.

Another reader suggested there should be a 32-bit version of DOS, to match the 32-bit processors used in late-model computers. This sounds like a worthwhile idea, but it may have already happened. The MS-DOS that lies beneath the latest release of Windows 95 uses a 32-bit disk operating system. Does this mean it is a 32-bit DOS? It's a little hard to tell; Microsoft tends to play down the existence of MS-DOS within Windows 95, but it's there all right. There will be some good info on this subject in next month's Madhouse.

Yet another message suggests something like AmigaDos. Now *there* was a computer that put a lot of present

designs to shame. The Amiga was a clean, slick, technical marvel. But it was badly managed, badly marketed, and eventually it bit the dust.

The Amiga was always thought of as a graphics computer, and many of them are being used right now for applications such as real-time video editing. And their games were absolutely phenomenal. But the Amiga could also be kicked into a command-line mode that looked and felt very much like Unix.

I owned an Amiga 500, bought primarily to develop Amiga versions of my Listening Post weatherfax and satellite software. It was a floppy-only machine, and I had various disks set up to boot either to AmigaDos or to its graphics mode, depending on what the disk was used for. It was very civilized.

This raises the matter of microprocessors. The Intel series of 80x86 is based on the original 8080 and Z80, which could only address 64K of memory. That was considered 'heaps' back then, but now with multi-megabyte programs so common, a lot of fiddling around is necessary to access memory blocks larger than 64K. (A file of '.COM' type is the original style, restricted to 64K or less. An '.EXE' file reaches beyond 64K.)

The Amiga (and early Macintosh) used the Motorola 68000 processor and its derivatives. These micros can directly address memory out to many megabytes, all in one straight line from start to finish. The 68000 series is wonderful to use; my weather software was written in pure 68000 machine code — so easy, so straightforward.

Maybe, just maybe, if we are designing a perfect computer from scratch, we should seriously consider going with something like the 68000. A couple of readers said that multitasking was important to them. Both Mac and Amiga handle multitasking easily, so the 68000 is a natural choice.

For what it's worth, I recently had to do some work on a big cabinet of 32 modems for our local ISP, upgrading them from 28.8kb/s to 33.6kb/s. The microprocessor driving the whole works was a good old 68000, used as an industrial controller.

Which raises another point: a couple of people said it was important that the perfect computer should be able to handle process control in real-time. They're talking about things like data sampling and acquisition, with timing down to the microsecond. What that means is direct access to the hardware via machine code routines. That's a no-no in Windows, but dead easy in a non-Windows environment.

More must-haves

Back to our ever-growing perfect computer: equal numbers of readers placed importance on battery capacity, keyboard quality, and a good fast modem. Battery capacity would be served by low clock speeds, CMOS chips wherever possible, and the ability to shut down any screen backlighting while outdoors, while still being able to read the screen.

It should also be possible to shut down the hard disk motor when it's not needed. One way, suggested by a correspondent, is to eliminate the hard disk altogether in favour of a solid-state mass storage method. This will come for certain, sooner rather than later. Right now you can get flash memory cards with up to 20MB capacity. This is the same as the first hard disks, and *they* grew to gigabytes; flash memory can too if the market is there.

The modem issue bears comment: a recent trend has been to remove functionality from the modem hardware and make the computer do the dirty work instead. This succeeds, more or less, in the very fastest and most powerful machines. But our perfect computer is going to be low speed, and low powered. So the modem must be of the traditional style, able to do its stuff on its own, without help from the host computer.

I suppose it is assumed that a CD-ROM drive will exist in the perfect computer; nobody specifically mentioned it. But a couple of people pointed out that there should still be a 3-1/2" floppy drive. Others objected to the current practice of equipping laptop computers with non-standard serial and parallel connectors, saying the perfect computer must have a 25-pin printer port and a 9-pin serial port, just like the big fellas.

And another request: a SCSI port, for connecting things like external tape drives or outboard disk or CD-ROM drives. I'd agree with that; I've set up quite a few SCSI devices. You just chain them all along the one cable and assign each device its own address. Fast and foolproof.

Next month we're going to continue along these lines, but more toward making your existing computer behave like the perfect computer. We'll discuss a method of exploiting the excellent MS-DOS that lies under Windows 95, for all it's worth.

Some of you have mentioned an MS-DOS Web browser. Such a program does indeed exist, in Czechoslovakia. We'll discuss the Opera Windows browser, and its use in small computers where nothing else will work. Be sure to tune in again next time, folks. ♦

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

February 1948

Radio May Pasteurise Milk: The new science of radiothermics, a direct outgrowth of research in high frequency broadcasting, first received notice when it provided a means of speeding production lines during the war, by completing in minutes industrial operations that had required hours or even days. Since then it has proved valuable in hastening output and reducing costs in peacetime manufacturing processes.

Experiments by RCA, in co-operation with the Walker-Gordon Company and the Borden Company, large Eastern (USA) dairy products manufacturers, suggest that passing milk through a glass tube with electrodes on the outside carrying RF current, can produce excel-

lent pasteurisation in about 67/1000 of a second. Many questions remain, but perhaps the most striking and promising fact of all is that milk so treated keeps longer than pasteurised milk we drink today. While ordinary pasteurisation kills most of the harmful bacteria found in milk, other non-harmful bacteria stay in the milk and cause it to sour. By eliminating these heat-resistant bacteria, progress has been made towards the development of a longer-keeping milk.

February 1973

EMI-Scanner wins Award: One of Britain's major engineering awards, the MacRobert Award, has been presented to Mr Godfrey Hounsfield, the inventor of the new EMI X-ray system for diagnosing brain diseases. Mr Hounsfield

was presented with a cheque worth \$50,000 by Prince Phillip for the technical innovation that most significantly 'contributes to Britain's prestige'.

Since the EMI-Scanner was introduced earlier this year, orders have been received totalling nearly \$1.2 million, of which \$800,000 worth have come from the USA. The EMI-Scanner is a system of computerised axial tomography. The patient's brain is examined as a series of layers by a scanning unit housing very sensitive X-ray detectors, which record the X-ray photons passing through the brain. In four minutes, during which time the fully conscious patient relaxes on the examination table, the scanning unit is rotated around the patient's head in 180 one-degree steps.

Fairchild now making TO-92 Plastic Transistors in Australia: A new manufacturing line for moulded plastic transistors in the Jedec TO-92 package is now in full production at Fairchild Australia's plant in Croydon, Victoria. Most of the production equipment used in the new line has been made by Australian manufacturers.

Approximately 10 different types of product are currently being made in the TO-92 package, including both bipolar transistors and JFETs. ♦

EA CROSSWORD

ACROSS

- 1 Current controllers. (8)
- 5 Device that passes selected components. (6)
- 10 Cutting tool. (7)
- 11 Radio hobbyist. (7)
- 12 Familiar atmospheric phenomenon. (4)
- 13 Given name of Schrodinger, originator of wave mechanics. (5)
- 14 Brand of power tool. (4)
- 17 Light-sensitive layer. (6)

- 18 The beginning of schooling, or bureaucratic paperwork! (4,3)
- 20 Pressurised water reactor. (1,1,1)
- 21 Many TV antennas are so positioned. (7)
- 23 Element used in a type of laser. (6)
- 26 Kind of cell with EMF of 1.2 volts. (2-2)
- 27 Planet. (5)
- 28 Acronym applicable to Harriers. (4)
- 31 Ten digitally. (3,4)
- 32 Metallic element found in 1801 by Hatchett. (7)
- 33 Substitutes for coins. (6)
- 34 Regularity of form. (8)

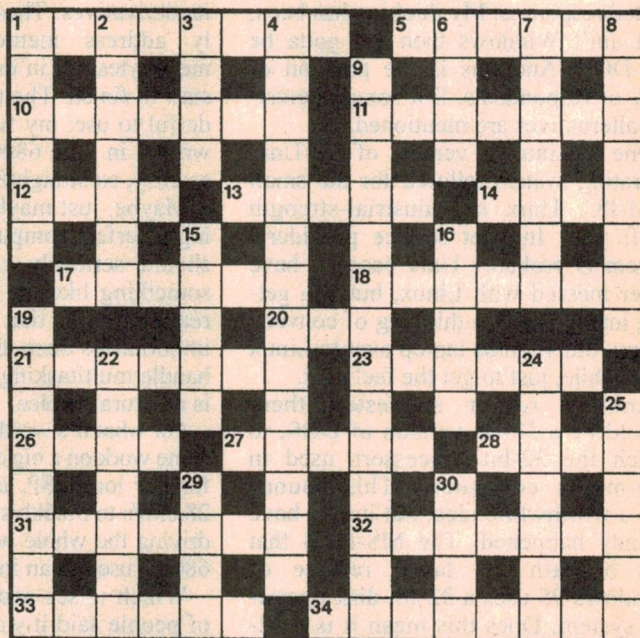
SOLUTION TO JANUARY 1998:

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S P U T N I K S   C S I R A C
O P U E   K I O H
D I S P L A Y   N E P T U N E
I I L B O E T M
U C L A   D O L B Y   H I F I
M O S A S G N S
I N S H O R E   A L B E R T
T A   D V D   O S
R E W I R E   A R T W O R K
A H P Z O S E L
M A I L   B E E P S   J A V A
S T Z N T L D S
T E T R O D E   E P I S O D E
O L O R S A U R
P R E A M P   I T E R A T E S
    
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DOWN

- 1 Most symmetrical solid. (6)
- 2 Gradient. (7)
- 3 Hyperbolic function. (4)
- 4 Who showed existence of charged atmospheric layer? (6,8)
- 6 Mega-screen system. (4)
- 7 Vibrating effect. (7)



- 8 Makes less dense. (8)
- 9 Part of EM spectrum. (5,9)
- 15 Binary 110010 in base 10 notation. (5)
- 16 Testing tool. (5)
- 19 Hard copy. (5-3)
- 22 Not occurring in high-demand time. (3-4)
- 24 Remove kinks. (7)
- 25 Structurally weak. (6)
- 29 Name of diagram used in logic. (4)
- 30 Support used for a microphone. (4) ♦

Electronics Australia's

Professional Electronics

S ♦ U ♦ P ♦ P ♦ L ♦ E ♦ M ♦ E ♦ N ♦ T

**IBM SELLS ITS WANGARATTA
PLANT TO LOCAL FIRM AIMING
AT CONTRACT MANUFACTURE**

**DVB PROJECT GROUP GIVES
SYDNEY DEMONSTRATION OF
DIGITAL TERRESTRIAL TV**

**THE EMC FRAMEWORK: WHAT
IT MEANS FOR SMALL FIRMS**

**LASER DATA TRANSCEIVER
SENDS AT 115kb/s OVER 450m**



**HP'S NEW 1660CP SERIES BENCHTOP LOGIC ANALYSERS:
4K MEMORY DEPTH, 250MHz STATE ANALYSIS & 100MHz TIMING
ANALYSIS ON ALL CHANNELS, PLUS A BUILT-IN PATTERN GENERATOR
TO PROVIDE A STIMULUS FOR DESIGN TESTING & VERIFICATION...**

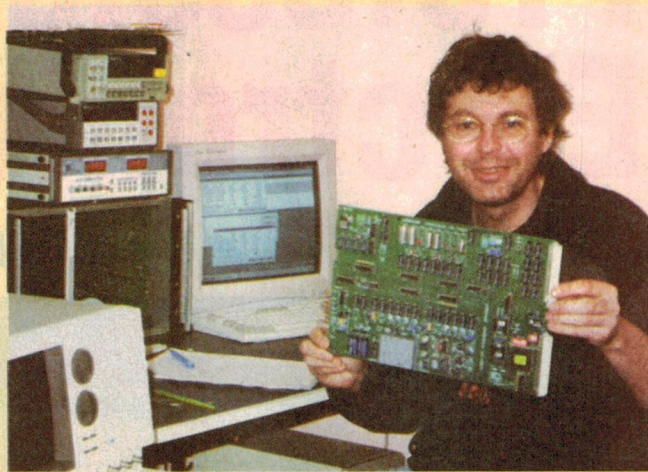
NEWS HIGHLIGHTS

EXPORT SUCCESSSES FOR BINARY ENGINEERING

Test and measuring specialists Binary Engineering International, based on the NSW Central Coast, have achieved notable export successes recently with their low-cost GPIB Smart Cables, and also their SMT-2000 automatic testing system.

BEI's manager and chief designer Tony Richardson says that the firm has just sold three of the GPIB Smart Cables to Russia's International Science & Technology Centre in Moscow, for use in its High Current Electronics Institute based in Tomsk, Siberia. The HCEI is using them for interfacing Tektronix scopes to their computer equipment. Other Smart Cables have been supplied to the USA (Lawrence Livermore Labs), Finland, and various other places.

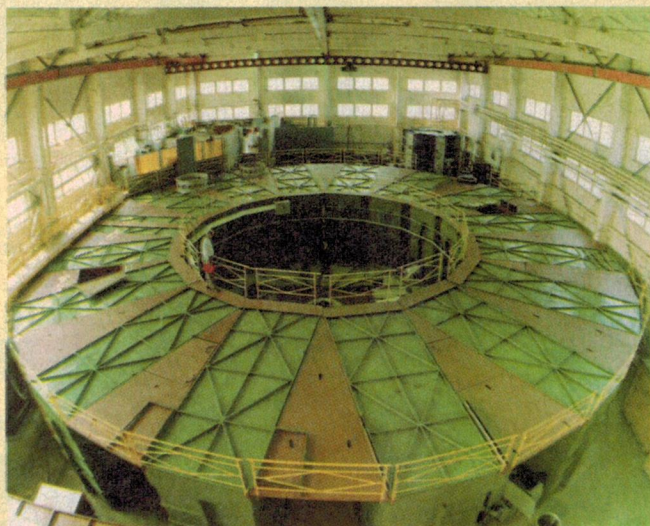
Established by the Russian Academy of Sciences in 1977, the HCEI is a recognized world leader in the development of powerful



microwave generators, high-density ion and electron beam accelerators, and pulsed X-radiation sources. The laboratory which has purchased the GPIB Smart Cables investigates the electrodynamic implosion of matter using a high-density plasma, created using pulses of millions of amperes. The pulses are delivered by the GIT-12 generator pictured at left.

Mr Richardson said that three of BEI's new SMT-2000 automatic testing systems have been sold to an organisation in Zurich, Switzerland, which bought them in preference to competing systems from Hewlett-Packard. Another three large systems have been sold to New Zealand. The latest version of the SMT-2000 includes two programmable power supplies, a programmable DMM, 128 analog I/O channels, 64-channel DDS, a function generator and all software — for less than \$10,000. Mr Richardson is shown above with the system's main PCB.

Further information on Binary Engineering's products can be found on its Web site at www.zip.com.au/~bei.



IBM SELLS ITS WANGARATTA FACTORY

IBM has announced the sale of its Wangaratta computer manufacturing plant to Bluegum Technology Pty Ltd, a newly formed majority Australian-owned company which plans to expand the plant's operation for contract manufacturing.

IBM will continue to use Bluegum's Wangaratta plant for the production of its desktop and midrange computers. All existing employees are being retained by Bluegum and the site General Manager, Mr Barry Sullivan, has been appointed a Director of the company.

"I am excited by this opportunity, which leverages IBM's manufacturing expertise and allows us to seek manufacturing contracts for other customers throughout Australia in the information technology, telecommunications, automotive and aerospace/defence sectors", Mr Sullivan said.

Bluegum is backed by local institutional investors, including Allen and Buckeridge, and Seventh Wave Ventures. The ANZ Bank has also providing financing and has acted as an arranger of debt and equity. IBM has no equity in the new venture.

Managing Director and CEO of IBM Australia, Mr Robert Savage, said that the Wangaratta plant has continued to be a great success story from its inception in 1976 as a typewriter factory to its current sophisticated, high technology operation. The plant now manufactures IBM's full range of desktop PCs as well as powerful RS/6000 computers.

"IBM will continue to benefit from product sourced from the proven quality Wangaratta plant, with its skilled workforce. IBM will be able to concentrate more resources on our core business which is increasingly the provision of IT services", Mr Savage said.

The move is in line with IBM's world-wide strategy to improve the efficiency of its manufacturing operations through a range of options including consolidation, outsourcing and moving fulfilment closer to the market.

Mr Paul Zuber, Principal and CEO of Bluegum, said "The Wangaratta plant represents this country's premier technology manufacturing facility. This has been achieved by commitment of the people at the plant. They are the principal asset of the business and Bluegum will succeed because of them."

"World-wide, contract manufacturing is growing at a rate of 20% a year on sales of about \$80 billion. We intend to take part in this industry's growth by serving the \$8 billion Australian market for electronic equipment manufacturing. Bluegum Technology plans to become one of the largest contract manufacturers in the southern hemisphere."

DVB-T DIGITAL TV TESTS, DEMO IN SYDNEY

The Digital Video Broadcasting Project (DVB) carried out tests and demonstrations of digital terrestrial television and digital HDTV in Sydney in December, using the DVB-T digital terrestrial broadcasting standard.

The DVB-T tests were part of a demonstration co-hosted by the Federation of Australian Commercial Television Stations (FACTS), and were transmitted from the TCN-9 tower in Willoughby. They were received in the Darling Harbour Convention Centre and also in a mobile van, used to demonstrate the robust nature of the DVB-T transmission technology.

The tests were historic in the sense that this was the first time DVB-T's COFDM (coded orthogonal frequency division multiplexing) technology was demonstrated in Australia. In keeping with the DVB's strong emphasis on cross-manufacturer interoperability, a broad selection of equipment from ITC, Harris, NDS, Sony and Barco was used for the tests and demonstrations.

Bruce Robertson, executive VP of Engineering for Nine Network Australia and chairman of FACTS' advanced transmission specialist group, which is currently investigating available solutions for digital terrestrial television, said "Ongoing field tests of the DVB system, together with laboratory test data already gathered on the European DVB system and a competing system developed in North America, should

provide us with the performance data we need to make the best decision for Australia on digital television."

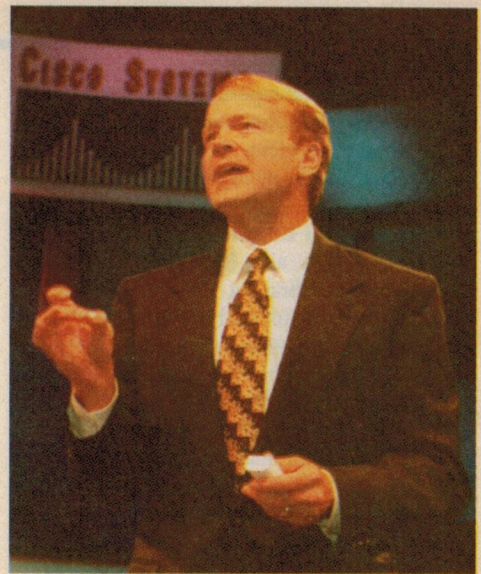
The Digital Video Broadcasting Project is a consortium of over 200 broadcasters, manufacturers, network operators and regulatory bodies in more than 30 countries worldwide, committed to designing a global standard for the delivery of digital TV. DVB-T is the terrestrial member of the DVB family of standards, and makes use of COFDM — a state of the art multi-carrier modulation technology — to ensure extreme flexibility in adapting capacity and ruggedness of signals to suit the 'hostile' nature of the terrestrial broadcasting environment.

INTEL VP REVEALS NETWORKING PLANS

Visiting Sydney in December, Intel executive vice president Frank C. Gill gave an outline of his company's plans to increase their involvement in networking products this year.

"Intel is serious about networking", said Mr Gill. "In addition to our historical strength of providing networking infrastructure products for mid-size businesses, we have dramatically expanded our product portfolio in the networking systems and management areas."

Mr Gill said Intel is also expanding its market focus to aggressively pursue small businesses (businesses with less than 50 employees), which the company expects to be a high-growth area as more companies



Keynote speaker at the recent Asia-Pacific IT Summit in San Jose was Cisco Systems CEO John Chambers, who predicted that electronic commerce will grow to a trillion-dollar market by the year 2000.

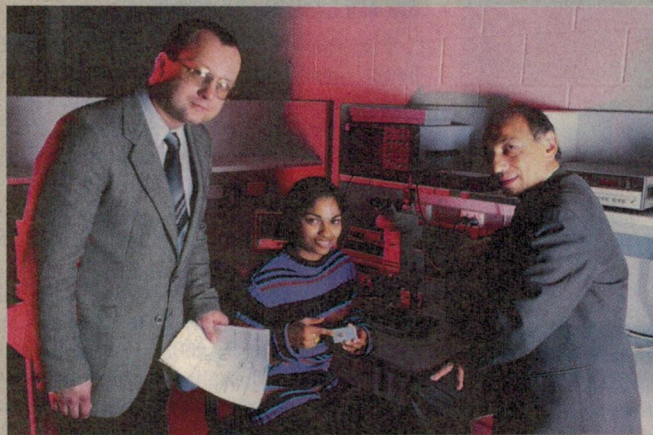
become knowledgeable about the competitive benefits of a 'connected' workplace. "There is a great deal of interest in Internet use and electronic business transactions among small businesses, and we can help these businesses use networking technology to gain a competitive advantage."

Intel's recent acquisition of Dayna Communications — a company specialising in small business networking products —

TEAM IN WA'S ECU DEVELOPING IMAGE SENSOR

Hidden amongst the bushland of Edith Cowan University's campus in Joondalup, WA, along winding corridors and in an unassuming laboratory, a devoted research team is leading the world in a quest for the advance of telecommunications. The ECU team is currently very close to developing a prototype for a compact mobile phone with features such as video communication, interactive banking, and global positioning systems for personal navigation.

"The aim of the project, nicknamed 'Captain Kirk', is to produce a prototype communicator with a mobile image sensor which is capable of real-time image capture and processing, with the built-in capability for image display, for multimedia applications," said Professor Kamran Eshraghian.



The project is a collaboration of international researchers lead by Professor Eshraghian, ECU's Foundation Professor of Computer and Communication Engineering, and supported by Professor Bill Crossland, Cambridge University, Dr Bobby Yu, University of Reading, Dr Neil Collings, University of Nuechatel and Professor Roberto Sarmiento and Dr Jose Lopez, University of Las Palmas.

ECU signed a non-disclosure agreement in 1996 with Motorola Inc., of Phoenix Arizona, to develop what will be the world's first interactive mobile multimedia communicator. Under this agreement, Motorola Inc provided access to a new technology — complimentary Gallium Arsenide (CGaAs).

Since the project began in 1996, significant developments have taken place.

"The research team have already demonstrated that it is possible to recreate primitive images using ferro-electric liquid crystals overlaid on silicon substrate in the form of 'smart pixels'. The demonstration is rather impressive in that it is possible to vary the contrast of each individual pixel action by time-division multiplexing or space-division multiplexing. In this way, it becomes possible to produce the grey scale, but the research team is also exploring implementing colour image capture and display through a variety of techniques", said Professor Eshraghian.

The ECU Centre for Very High Speed Microelectronic Systems is involved in a number of high performance and high speed vision based systems including smart sensors based upon insect vision and a novel technique for an integrated real-time video capture, compression, coding and display systems.

provides added expertise in creating unique networking solutions for this rapidly growing market segment.

"Intel was a primary driver in moving the marketplace worldwide from 10Mb/s to 100Mb/s Fast Ethernet. In markets such as China, Korea and Malaysia, Intel's customers are embracing 100Mb/s connectivity even faster than analysts projected", Gill said. "I'm very pleased with our progress in Asia Pacific. This is our fastest growing geography in the world."

Intel claims to sell more FE adaptor cards than any other manufacturer in the three largest markets in Asia: PRC, Korea and Australia. The company says it has also captured the number one market segment share for FE Hubs in Korea, Malaysia and PRC.

INTERNET WILL BRING PEACE, SAYS NEGROPONTE

Well-known promoter of digital communications Nicholas Negroponte, head of the Media Laboratory at MIT, has told an information technology in Brussels that far from being oversold, the Internet has been seriously undersold in terms of its importance for humanity.

"I have never seen people miss the scale of what's going on, as badly as they are doing now", Mr Negroponte said. He predicted that the Internet would in fact bring world peace, by bringing down national borders. "Twenty years from now, children who are used to finding out about other countries through the click of a mouse are not going to know what nationalism is."

"Access by kids to the Internet should be like them breathing clean air", he added.

The US Government was among those who had underestimated the Internet's impact, he noted, pointing out that it had predicted that electronic commerce would amount to around US\$300 billion by 2001. In fact the figure is more likely to be US\$1000 billion, said Mr Negroponte, as there will probably be over one billion people using the Internet worldwide by 2001.

He pointed out that in the USA some 85% of all teenagers have access to a personal computer at home, and virtually all 14 year olds are 'digitally literate'.

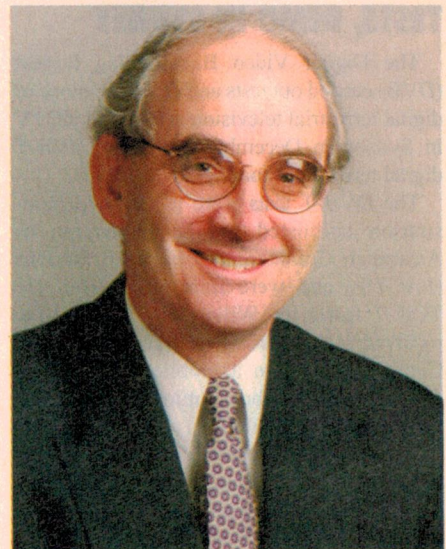
AUST MODEM & NET TAKE-UP RATE 'LOW'

Australians are lagging behind in their domestic use of electronic communications and the Internet, according to the Australian Bureau of Statistics. Of the estimated 4 million home computer users only 300,000 (7.5%) accessed the Internet, 200,000 (5%) used electronic mail, and 100,000 (2.5%) accessed other online services/databases according to the recently released ABS survey *Household Use of Information Technology*.

The highest proportion of home computer users were the 5-17 year olds (41%), followed by the 18-24 year olds (29%), 25-39 year olds (23%), 40-54 year olds (25%), and persons 55 years and over (7%).

Home computer users (who were 18 years and over) were more likely to be males in a professional occupation, who use computers at work and who have used computers for several years. However they were just as likely to be overseas born as Australian born.

Households in the Territories showed



Former Lucent Microelectronics chief technical officer Mark Melliar-Smith has been appointed as the new CEO of SEMATECH, the US semiconductor industry's R&D consortium. He succeeds Bill Spencer, who is now SEMATECH chairman.

highest use of computers, with the ACT (51%) and Northern Territory (35%) followed by Victoria (34%), New South Wales (30%), South Australia and Western Australia (29% each), Queensland (28%), and Tasmania (25%).

Two million (31%) Australian households frequently used a computer. These two million households used 2.6 million computers. Over 0.5 million households had a modem, and nearly one million households had CD-ROM equipment.

Over half the households reported that their most powerful computer had an IBM compatible 486 processing capacity or greater, and about one in five reported their most powerful computer had more than 16MB of RAM.

INMARSAT CAR PHONE IN RECORD ATTEMPT

The first in-vehicle Inmarsat-phone is being used by a three-man team of endurance drivers in their attempt to set a world record in circumnavigating the globe. In November the team crossed Australia from west to east in a 4500km 100-hour leg, after completing a harrowing 12,000km journey through Europe and the Indian Sub-Continent.

The team, in a General Motors Vauxhall Frontera four-wheel drive, left London on October 1 on the 58,500km journey which took in the Australian continent, New Zealand, North America and back via Madrid to London. Canadian Garry Sowerby, former



After testing nine different flat panel displays, with a view to replacing its bulky CRT monitors on the trading floor, the Sydney Futures Exchange decided that only one passed the test: the Hitachi Super TFT, which was visible over the widest angles. Now the SFX has ordered 60 of the panels for use in its trading room and new Electronic Centre.

Welsh policeman Colin Bryant and Vauxhall engineer Graham McGaw were hoping to complete the round-the-world trip in less than four weeks of driving.

Australia has been targeted by Inmarsat as potentially the world's leading market for in-vehicle satellite phone usage, because of the vast distances and remote areas in which companies have to operate. The primary users of the global satellite phone are expected to be long-haul trucks, trains and off-road vehicles travelling in outback regions not covered by fixed or cellular communications. Some 90% of the Australian land mass is still uncovered by cellular communications.

The Inmarsat-phone offers digital phone, fax and data services including voice/fax mail notification and internet access. In-vehicle phones have dynamic satellite-tracking antennas for cars, trucks, coaches and trains; other portable terminals are smaller than an A4 laptop computer and weigh around 2kg. The in-vehicle phone being used by the Frontera team is manufactured by Thrane & Thrane of Denmark. The unit costs from US\$5800 and call charges are approximately US\$3 per minute.

POWERFUL SATELLITE FOR LATIN AMERICA

A powerful Hughes Galaxy VIII-i satellite has been launched from Cape Canaveral in central Florida, and is due to begin broadcasting DirecTV to South American countries this month.

The satellite was built by Hughes Space and Communications Company (HSC), the world's leading manufacturer of commercial communications satellites, for PanAmSat Corp., a leading global provider of satellite-based communications services, of which Hughes Electronics is a major shareholder.

The new satellite is a body-stabilized Hughes HS 601 HP (for high power) model. Generating 9.9 kilowatts, Galaxy VIII-i is one of the most powerful commercial spacecraft ever launched. It's also the second HS 601HP in PanAmSat's fleet of 17 satellites,



Engineering student Gunter Feiss, who won Germany's recent national 'Youth Research' competition, explains his high-sensitivity laser speed sensor project to the country's Research Minister Jurgen Ruttgers. (IN-Press/dpa)

joining PAS-5 that was launched last August.

Galaxy VIII-i will be used exclusively by Galaxy Latin America, covering Mexico, Central America, South America and the Caribbean. Half the 32 Ku-band transponders will carry Spanish-language DIRECTV programming, and the other half will carry programming in Portuguese.

SAMSUNG CELEBRATES 10YRS IN AUST.

Samsung Electronics has celebrated its 10th year of operation in Australia, having been incorporated in July 1987 and launched its first products (TV sets) into the Australian market in November 1987.

Samsung Electronics Australia is a wholly owned subsidiary of the Samsung Group and is the Australian distributor of products made by Samsung Electronics Company (SEC). Fully integrated, SEC is capable of turning raw materials into highly sophisticated video and audio products, appliances, information systems, computers, semicon-

ductors and entertainment products.

The first years for Samsung Electronics (Aust) were difficult, but year by year Samsung products increased their market share. The TV sets built brand name recognition in the consumer electronics market, and the introduction of Samsung microwave ovens further increased Australian consumer's awareness of the Samsung brand and of the company's presence within the community.

As the company grew it released more and more products into Australian shops until nearly all of SEC's main consumer electronic products. Today TVs, VCRs, video cameras, fax machines, refrigerators, washing machines, air conditioners, mobile telephones and computer products are widely available to Australian consumers through a national reseller network of over 1000 retail stores. The company now achieves sales of \$170 million per annum in consumer electronics, telecommunications equipment, systems and computer monitors and peripherals, and says it's on track to achieve sales of \$200 million by the year 2000.

NEWS BRIEFS

- **Advanced Solutions** Pty Ltd (Sydney) has been appointed exclusive Australian distributor for Nanjing Xeltek Electronic Co Ltd (Nanjing, China), which designs and manufactures a range of universal device programmers that work through the parallel port of a PC.
- A number of courses are being held around Australia by **American Research Group** on Cisco router software configuration. For details phone 1800 647 468.
- **EUPEC GmbH & Co. KG** (European Power Semiconductor and Electronics Company), formerly the AEG Power Semiconductor Division, has taken over the responsibility for all Siemens BSM IGBT and MOSFET modules following a takeover of EUPEC by Siemens AG in October 1996.
- The first **Perth Electronic Show** will be held in the Burswood Superdome in June 1998. For details phone (08) 9444 6310.
- **Fastron Technologies** has moved to new premises. The new address is 25 Kingsley Close, Rowville 3178; phone (03) 9763 5155, fax (03) 9763 5166, email fastron@oze-mail.com.au, Web site www.fastron.com.au. ♦

OPTUS TO CARRY OZEMAIL NET TRAFFIC

OzEmail Limited and Australia's largest private telecommunications carrier Optus Communications have signed two agreements, under which OzEmail will purchase discounted wholesale bandwidth from Optus for its Internet services, and also defining future areas of opportunity for OzEmail and Optus to work together. OzEmail claims the latter agreement has the potential to restructure the current wholesale Internet market in Australia. ♦

NEW PRODUCTS

New HP analysers generate patterns too

Hewlett-Packard has released a new series of benchtop logic analysers with a built-in pattern generator that provides stimulus for functional testing of digital designs. The built-in pattern generator allows designers to test system subcomponents earlier in the design cycle by substituting for incomplete boards, integrated circuits or buses. It also allows testing and verification of a design to proceed when components are missing or late.

Prior to the HP 1660CP series, stimulus was available only in high-end modular logic analysis systems, such as the HP 16500C, and cost-conscious designers often spent time developing custom test hardware to provide stimulus. Although capital-equipment budget was saved, time-to-market oppor-

tunities often were sacrificed because time was spent developing custom test hardware rather than the end product.

The built-in pattern generator also allows software developers to create infrequently encountered test conditions and verify that their code works before the hardware is available. Engineers can generate the patterns necessary to put their circuits in a desired state, operate them at full speed or single-step them through a series of states.

The HP 1660CP series offers four models, with varying state and timing channels. Each model has 100MHz state analysis and 250MHz conventional timing analysis on all channels, with 4K memory depth per channel. In half-channel mode, timing-analysis speed is increased to 500MHz and memory depth to 8K. The pattern generator pro-



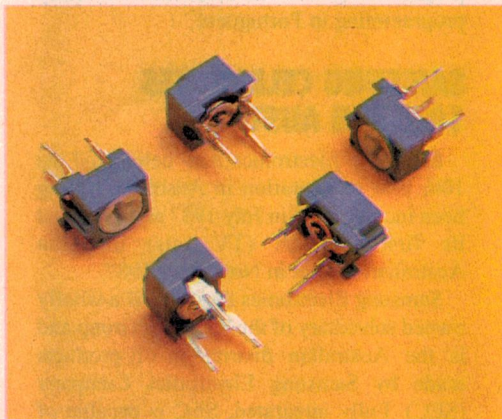
vides a 258,048-vector deep memory and up to 32 data channels at 100MHz clock speed or 16 data channels at 200MHz clock speed.

For further information circle 249 on the reader service card, call HP's sales information line on 1800 629 485, or on the Web go to <http://www.hp.com/go/logic-analyzer>.

High quality trimpots

Jaycar Electronics is now stocking a range of high quality compact trimpots for through-hole PCB mounting, from highly regarded Spanish manufacturer Piher. The trimpots are of the 'horizontal' enclosed type, so that the resistive element and wiper are protected against ingress of dust and corrosion.

Overall dimensions of the pots are 8.7 x 6.4 x 11mm (LxWxH), with the body of a mounted pot extending 7.6mm above the PCB. The ele-



ment pins are spaced on 5mm centres, with the rotor pin spaced 5mm away on the centre axis.

Jaycar is currently stocking the pots in 12 values, from 200Ω to 1MΩ in a 2-5-1 value sequence. Rated electrical life of the pots is 1000 hours at 40°C and 100mW dissipation. The rated temperature coefficient of resistance is +/- 300ppm between -25° and +70°C (values between 1kΩ and 100kΩ).

All values are priced at 70 cents each in single quantities. The pots are available at all Jaycar stores.



AC/DC current clamp for DMM

The new Fluke i1010 and i410 AC/DC current clamps are battery-powered Hall effect clamps that extend the AC and DC current measurement range of a digital multimeter. The i1010 clamp measures DC currents from 1A to 1000A and AC current to 600A. It also includes a zero control which compensates for residual core magnetism in the clamp, to improve accuracy at low current levels. It will measure up

to a crest factor of three at 600A at an accuracy of 2%. The i410 clamp measures AC or DC current from 1A to 400A with an accuracy of 3.5%.

Both probes have a DC offset control to cancel the effects of stray magnetism, shielding for use in electrically noisy environments, and a shielded silicone rubber cable for high-temperature environments such as automotive testing. A battery test function and a power-on LED are incorporated in the probes.

For further information circle 248 on the reader service coupon or contact Philips Test & Measurement, 34 Waterloo Road, North Ryde 2113.

Compact AM/SSB CB radio

The Mundara SY-201 is a new, small handheld SSB/AM 27MHz CB radio that features long range SSB capability and 40 channels, making it suitable for sporting, hobbyist and other outdoor activities. When used without its battery pack (e.g., via a car adaptor), the radio is about the size of a standard microphone.

Features include selectable low/high power; upper or lower sideband mode selection; and an LCD display that shows channel number, frequency readout, mode, battery condition and S-meter. It also has memory which retains the operating mode, a dual-watch capability for monitoring two channels simultaneously, one touch emergency channel 9 operation, scanning of all 40 channels or programmed memory only channels, and single button last channel recall.

The power output on AM is 1W (low) and 4W (high); on SSB it's 2W PEP (low) and 4W PEP (high). Other features include battery life enhancement circuitry and a slide-on battery pack which accepts AA size alkaline, NiCad or NiMH batteries.

For further information circle 245 on the reader service coupon or contact GFS Electronics, PO Box 97, Mitcham 3132. ♦



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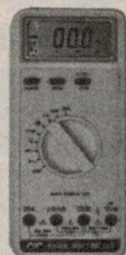


< CIE 128 Automotive DMM

- 3200 count
- RPM, dwell, duty cycle, μF , temp, freq
- Vdc, Vac, Ω , 10A
- Auto off

CIE 8088 Automotive DMM >

- 3999 count
- RPM, pulse, dwell, duty cycle, μF , temp, freq
- Vdc, Vac, Ω , 20A



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- Vdc, Vac, Ω , 20A
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CIE 8060T Temperature DMM >

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- Data Hold, Mem, Rel.



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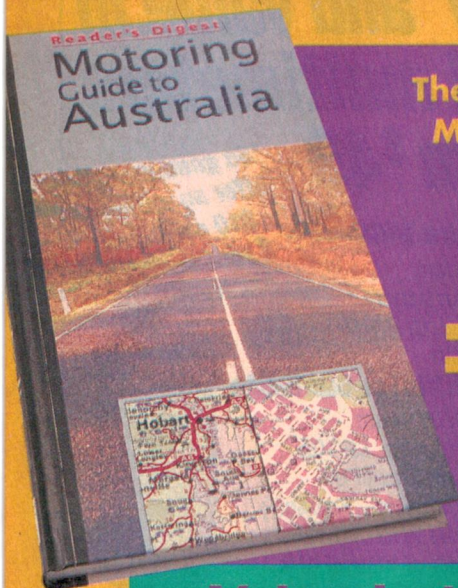
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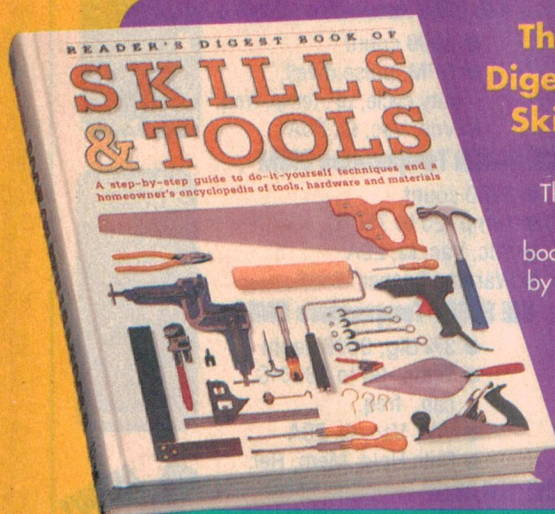


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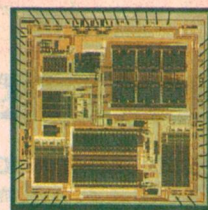
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Safety IC for Li-Ion packs



Philips Semiconductors has launched a new safety IC that protects Li-Ion battery packs against misuse. If short-circuited, these batteries are a severe fire and explosion hazard. If incorrectly charged or discharged, their energy storage capacity is seriously impaired.

The SAA1502A safety IC is designed to be built into a battery pack, and claims to provide effective current limiting during both charging and discharging of an Li-Ion cell. It also automatically disconnects the pack if a cell approaches either an over-charge or deep discharge state — conditions that can affect the cell's recharge cycle life, or even cause a safety hazard.

The IC starts up correctly from a zero-voltage condition, so Li-Ion cells don't need to be charged before being assembled into a battery pack. Fabricated as a multi-chip module, the chip incorporates a BCD PowerLogic controller and a TrenchMOS dual power MOSFET chip.

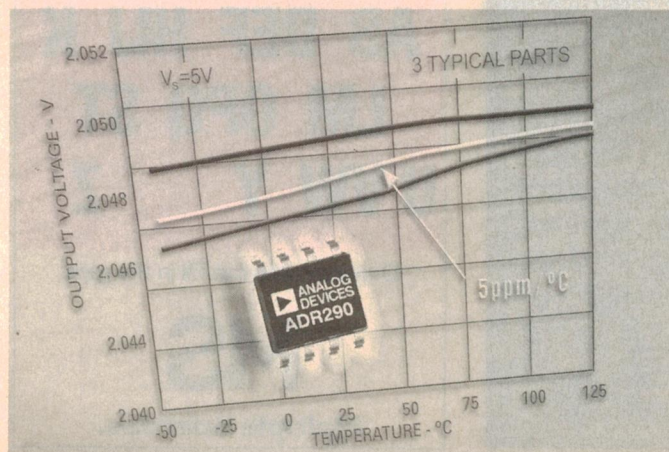
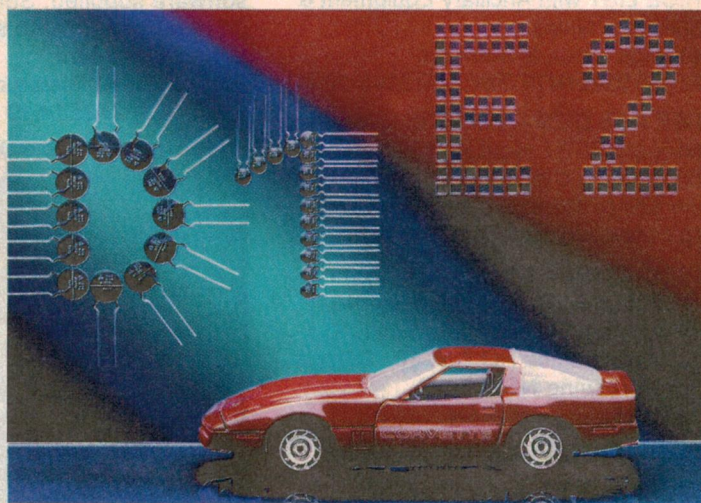
For further information circle 271 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113.

SMD varistor handles 25J/1200A

Two new series of automotive over-voltage protection devices have been announced by Siemens Matsushita Components: the radially leaded D1 disk series and the E2 surface-mount series of varistors. The D1 varistors have a maximum operating temperature of +125°C with full DC and load-dump capability. They can survive a thousand temperature shocks between -40 and +125°C. Typical applications include use in motor controllers or protection of high voltage gas discharge lamps (HIDs). Diameters range from five to 14mm, the latter being able to absorb up to 50J of load-dump energy.

The E2 varistor is an SMD varistor with a 25J load-dump energy absorption capability that can withstand a maximum current surge of 1200A. It also features a protection level of 40V at 10A and a temperature range to +125°C.

For further information circle 272 on the reader service coupon or contact Siemens Ltd, 544 Church Street, Richmond 3121.



Low noise voltage reference

Analog Devices has announced its ADR29x family of low noise, micropower, precision voltage references. The devices are based on new XFET architecture that is claimed to give better temperature coefficient linearity, lower noise, and lower thermal hysteresis compared to bandgap voltage references.

The ADR290/1/2/3 devices have reference voltages of 2.048V, 2.5V, 4.096V and 5V respectively and operate from either 2.7V, 3V or 5V. The quiescent current is 12uA, and noise is about one quarter of that from an equivalent bandgap device.

The devices are suitable for use in low-power applications, such as battery-operated devices, as well as instrumentation, communications and loop current-powered transducers.

For further information circle 276 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940.

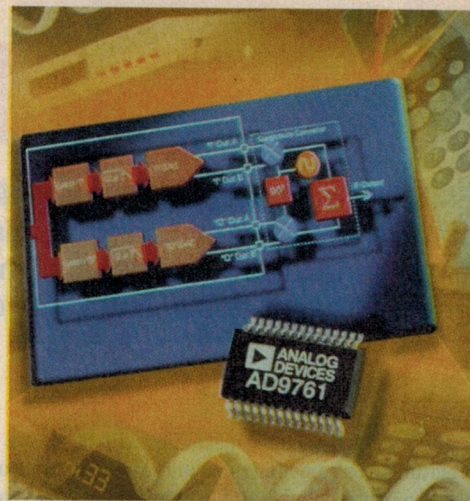
Dual 10-bit DAC runs to 40MS/s

The AD9761 from Analog Devices is a complete and highly integrated dual 10-bit digital to analog converter (DAC) in a compact 28-pin SSOP package. It is designed for both wide-band and narrowband communication applications that use quadrature modulation schemes (i.e., spread spectrum, TDMA), where I and Q information is processed during transmit operations.

The IC contains two 10-bit 40MS/s DACs, dual 2x digital interpolation filters, a voltage reference, and multiplexed digital input interface circuitry.

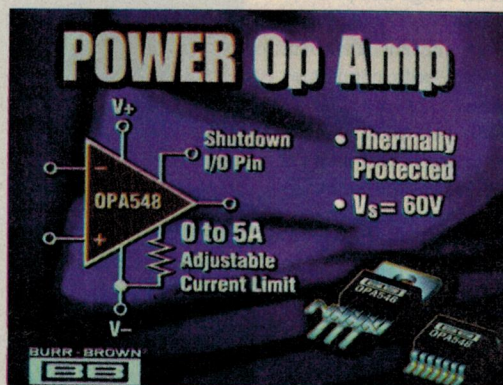
It supports a 20MS/s per channel input data rate, which is interpolated by 2x up to 40MS/s before simultaneously updating each DAC. The chip has differential current outputs, for either single-ended or differential interfaces. It operates from a single supply from 2.7V to 5.5V and consumes 200mW (at 3V, 40MS/s) during transmit operation. Power consumption can be reduced to below 50mW at lower data rates.

For further information circle 273 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940.



Power op-amp

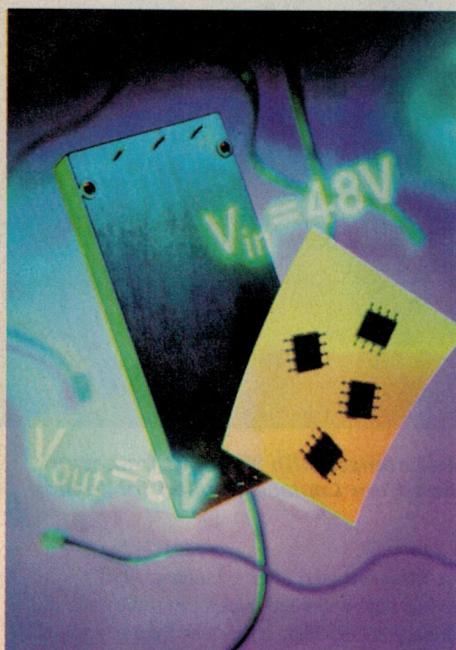
Burr-Brown's new OPA548 is a low cost, high-voltage, high-current operational amplifier capable of driving a wide variety of loads. It operates from either single or dual supplies up to +60V (+/-30V) and is internally protected against current overload and over-temperature conditions. It features an enable/status pin which disables the output and also indicates if the amplifier is in thermal shutdown mode.



The OPA548 has a user-selected current limit of zero to 5A, and instead of a resistor in series with the output current path, the IC senses the output current indirectly. This allows the current limit to be programmed with a 0 - 330uA control signal. It has a common-mode rejection of 95dB and an open loop gain of 98dB.

For further information circle 279 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130.

Tiny 80V, 100V MOSFETs



TEMIC Semiconductors has added four new devices to its line of Little Foot power MOSFETs. The N-channel devices include the 80V Si4480DY (single) and Si4980DY (dual) and the 100V Si4482DY (single) and Si4982DY

(dual). The Si4480DY can handle up to 6A and has an on-resistance of 35 milliohms, while the Si4482DY is rated at 4.6A, with an on-resistance of 60mΩ. The MOSFETs are suitable for use in switchmode power supplies and line cards for telecom applications, and are said to give a better performance than many devices in larger packages.

For further information circle 274 on the reader service coupon or contact Braemac Pty Ltd, 1/59-61 Burrows Road, Alexandria 2015.

High intensity LEDs

Ampec Technologies has introduced the DDP N series of high intensity LED lamps. They are designed to replace incandescent bulbs and are available in amber, orange and red. The LEDs feature new absorbing substrate aluminium indium gallium phosphide (AS AlInGaP) chip technology, claimed to produce a high light output over a wide voltage range.

They are available in any standard lamp-based package, and have a rated life of 100,000 hours. Various standard voltages from 5V to 120V AC/DC are available.

The LEDs are said to be visible in bright sunlight, and the lens contains

both UV-a and UV-b inhibitors. The amber LED has a wavelength of 592nm and a light output of 1.3cd, the orange LED is 609nm and 1.3cd, and the red is 635nm with an output of 0.9cd.

For further information circle 277 on the reader service coupon or contact Ampec Technologies P/L, 4 Wetherill Street, Silverwater 2264. ♦

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READER INFO NO.14

EMC — THE REALITIES

EMC or electromagnetic compatibility is now a reality in Australia. With it has come a whole new set of rules, enforced by complex legislation, fines, jail sentences and on-the-spot audits of small and large companies who import or make electrical and electronic products. In this article we look at what EMC is all about, and some of the possible ramifications for consumers and small business.

by PETER PHILLIPS

Most readers of this magazine will be aware of EMC, probably regarding it as something that only manufacturers of electrical products need to worry about. But it's not quite that simple, as this article explains. In fact, it's likely to have an impact on the range and price of products you'll be able to buy. In particular, it's already affecting many small companies who make, import or sell electronic and electrical goods. There are now random audits taking place, with companies being targeted through their advertisements in magazines like *EA*.

We recently visited such a company after an audit, and spoke with the proprietor and the auditors. It's clear from what we found that EMC is going to affect everyone. There are now many obligations that suppliers of electrical goods need to follow, with these obligations increasing next year when EMC requirements become even broader than they are now.

Europe and Britain introduced EMC about three years ago, and Australia started in 1996 when administrative arrangements were put in place. Other countries such as the US haven't so far followed the European lead, so at this stage Australia is at the forefront.

Before we discuss the possible effects of EMC, first a look at what it's all about, along with the legal requirements imposed by the legislation. The following information is derived from documentation dated April 1997 supplied to companies that need to comply with the legislation.

Why EMC?

Electromagnetic compatibility (EMC) refers to the ability of an electrical or electronic device or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic interference (EMI) to anything in that environment. In other words, EMC is a way of controlling pollution of the frequency spectrum. This has become important as a result of the increasing use of digital circuitry and mobile communications.

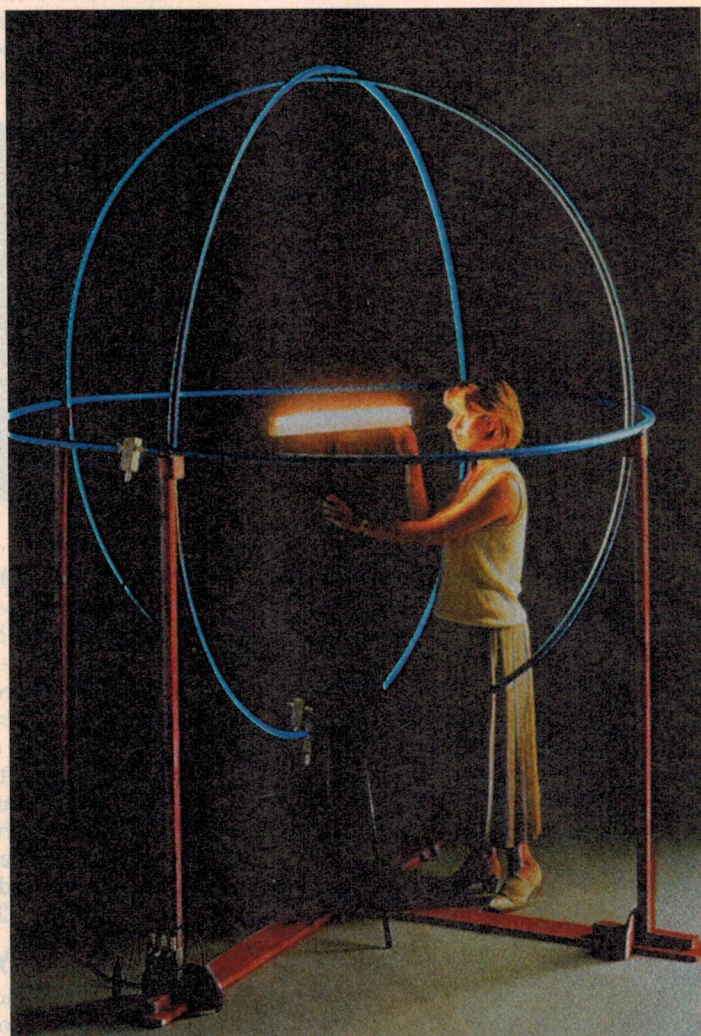
If left unchecked, we could end up with a frequency spectrum full of unwanted and unnecessary 'RF noise', limiting the use of this very finite resource. Controlling EMI is now considered so important that Australia has introduced the *Electromagnetic Compatibility Framework*. The primary responsibility for the EMC framework lies with the Australian Communications Authority (ACA), formerly called the Spectrum Management Agency (SMA). The framework is based on standards made under the *Radiocommunications Act 1992*. These have been adapted from international standards, and will be progressively extended over time.

The current position

The ACA has divided the EMI problem into four sectors: commercial, residential and light industry; installation/maintenance; automotive; and heavy industry. Of most interest to us is the first sector, which covers white goods, brown goods, office equipment, and consumer electronics.

At this stage the framework covers only one aspect of EMC — radio frequency generation, as shown in Table 1. The framework will be extended to cover all parts of this table, to eventually include *immunity* from the effects of interference.

The EMC framework in Australia was introduced in January 1996, and compliance become enforceable in January 1997. Products that are



Even light fittings must comply with the EMC framework. This three-axis antenna from Laplace is used for testing compliance.

currently affected are those first marketed after 1 January 1997.

Products released before this date will need to comply if they are still being marketed after 1 January 1999. That is, in less than a year, all products related to the residential, commercial and light industry sectors must comply.

Exemptions

There are of course a number of exemptions, such as those products covered by other regulatory agencies. These agencies include Austel, Air Services Australia and the Commonwealth Department of Defence.

Also exempt are educational electronic equipment and some items of test equipment. Other exclusions are export items, rental equipment, prototypes, spare parts and second hand apparatus.

The documentation lists a number of other exemptions, some of which are quite specialised. If you want a complete list of the exemptions, contact the ACA.

Compliance requirements

So, how does a supplier prove that a product offered for sale complies with the framework? In general, a supplier must satisfy four basic requirements — establishing sound technical grounds for product compliance; making and holding a declaration of conformity; maintaining a compliance folder and labelling the product in a specified way.

By the way, a supplier is defined as a manufacturer or importer of the goods offered for sale. Most companies in Australia that sell electronic items also sell imported items, so clearly they are affected by the legislation. Let's look closer at the requirements, as they are perhaps more significant than you might first think.

Compliance can be demonstrated by one of two routes: a test report, or through what's called a *technical construction file* (TCF). But in the end a supplier must make a declaration of conformity, which is a formal attestation that the product meets the EMC requirements. This document is not equivalent to a test report, nor is it adequate as the sole basis for marketing a product, as it states only that all products of that type conform. It therefore means that an importer needs to also consider the quality control system of the manufacturer and any conditions attached to the use of the device.

However, a declaration of conformity is considered critical as a way of achieving access to the Australian market. It must be completed and held in Australia by the supplier responsible for placing the product on the market. For an Australian product, this is normally the manufacturer. For imported goods, it's the Australian importer or agent.

Responsibility

Perhaps the most important aspect of a declaration of conformity is that it must be made by someone who is in a position to accept *personal* responsibility. Under the *Radiocommunications Act 1992*, it is an offence to 'knowingly or recklessly make a false or misleading statement'. That is, the individual who made the declaration is liable, not the company.

The ACA suggests that all retailers and wholesalers must satisfy themselves that a product is covered by a supplier's declaration of conformity. The compliance model is shown in Fig.1.



This 1GHz spectrum analyser from Laplace is PC-controlled and is intended for in-house EMC testing.

Compliance folder

This folder contains all documentation that supports the declaration of conformity. It may include test reports or a technical construction file, a description to positively identify the product (including a colour photo and/or a block diagram), reference to the specifications for conformity, and a technical description of the apparatus. The specifications for conformity should refer to the mandatory standards applied to the product, and also to

the manufacturer's quality control system.

All components of the compliance folder can be held outside Australia, except the declaration of conformity. However, for audit purposes, all parts of the folder must be accessible to the supplier within 10 working days. Penalties apply if the compliance folder is not made available within 10 days of written advice being issued by the ACA, or if it is incomplete at the time of audit.

Compliance through testing

For most products, testing to the mandatory standards is the usual way to prove compliance, after which a declaration of conformity can be made, and the product duly marked. The ACA recommends that suppliers use test results from a NATA accredited laboratory or from a mutual recognition agreement (MRA) partner laboratory overseas. Test reports from overseas laboratories must be written in English, and photocopies must be certified.

If testing is done through a non-accredited laboratory, the ACA reserves the right to query conformity and to request more evidence of compliance. Any additional expense must be met by the supplier if an auditor considers the product needs further testing at a laboratory nominated by the ACA.

Compliance through a TCF

A technical construction file (TCF) is an alternative where testing is impractical. A TCF has two components: that part completed by the supplier with supporting evidence of compliance, and an inspection report made by

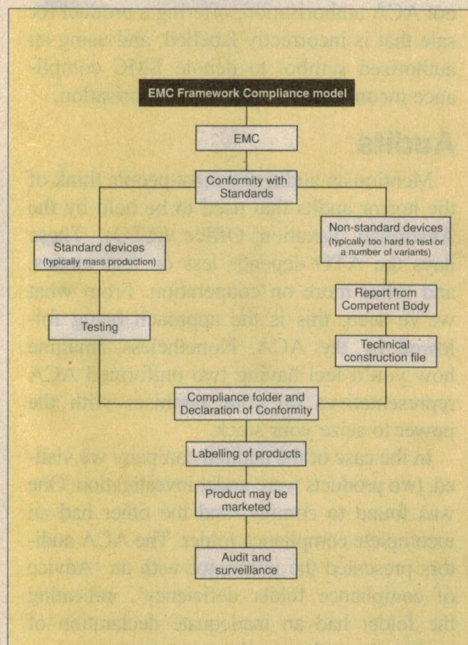


Fig.1: This flow diagram shows how EMC compliance can be accomplished through either testing or a technical construction file.

a Competent Body that verifies the claims made by the supplier. A Competent Body is an organisation appointed by the ACA on advice from NATA. Those currently appointed are listed in the documentation.

When completed, the TCF should contain a description of the product; a technical rationale for using a TCF instead of testing; a statement of the steps taken to manage the emissions and/or susceptibility characteristics of the device, including reference to standards applied to the product; all relevant technical reports; and any reports issued by the Competent Body.

Labelling

Before a product can be marketed, it must be labelled. The purpose of the label is to provide a traceable link between the product and the supplier responsible for placing the product on the market. There are a number of conditions for labelling, such as its location, method of marking, size and colour of the label. As well as a compliance label, the product must also be marked in such a way that the person responsible for placing the product on the Australian market can be identified. This is either the manufacturer or the importer (or agent).

The C-tick mark is the recommended label to show compliance, which must be accompanied by the registered name and address of the supplier, the company's Australian Company Number (ACN), a supplier code issued by the ACA or a trademark/name registered in Australia.

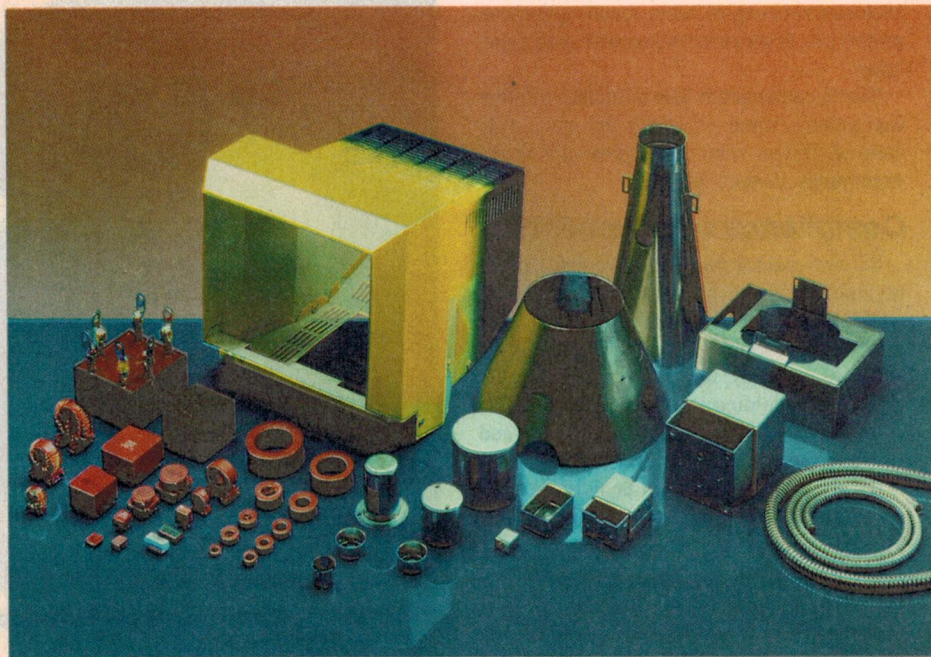
Enforcement

To make the legislation work, the ACA has been empowered to conduct random audits of suppliers. At this stage, if a company is targeted, the ACA sends a letter advising the proprietor of a proposed date of audit. For the audited company we visited, the letter stated that the auditors intended to review two specific products mentioned in the company's magazine advertisements. It also said: 'All other products you market which fall within the scope of the framework many also be subject to audit at this time.'

The main thing the auditors look for is the compliance folder, which should include the original copy of the declaration of conformity. If the folder is incomplete, the ACA can select three random samples of the product for evaluation by an accredited laboratory nominated by the ACA. As already mentioned, any costs must be met by the company being audited.

Offences & penalties

Quoting the documentation: 'If a product offered for sale does not comply, the supplier may be subject to prosecution under the Act. Prosecution for supplying non-standard devices could result in significant penalties,



Suppression of, and immunity to EMI in an electronic or electrical product often means additional shielding and circuitry. Shown here are some of Vacuumschmelze's large range of EMC products.

including seizure and forfeiture of non-standard stock and monetary penalties for individuals and companies. In addition, a failure to prepare and maintain a compliance folder for a device, in accordance with ACA requirements, may constitute a number of offences.'

Other offences include using a C-tick without ACA authorisation, offering a product for sale that is incorrectly labelled, and using an authorised symbol to denote EMC compliance inconsistently with that authorisation.

Audits

Mention an audit, and most people think of the horror audits that used to be held by the Australian Taxation Office (ATO). These days the ATO depends less on fear tactics, and relies more on cooperation. From what we've seen, this is the approach being followed by the ACA. Nonetheless, imagine how you'd feel having two uniformed ACA representatives on your premises with the power to seize your stock.

In the case of the audited company we visited, two products were under investigation. One was found to comply, and the other had an incomplete compliance folder. The ACA auditors presented the proprietor with an 'Advice of compliance folder deficiency', indicating the folder had an inadequate declaration of conformity and an inadequate test report.

The device concerned was a security camera imported from Korea, certified in Germany. The ACA requested that a certified copy of the declaration of conformity and a copy of the test

report be obtained and held in the folder. To ensure the company does this, the ACA auditors advised they would return in 28 days.

While on the premises, the auditors examined other items offered for sale, but as most of these were exempt (at this stage), nothing further happened. The auditors were friendly, efficient and were clearly not out to 'catch' the proprietor. Only time will tell if this will be the approach in years to come.

The effects

When asked how the EMC requirements would affect him, the proprietor of the audited company said the company would be limiting the range of imported items it offers. Another problem was the time needed to maintain the compliance folder on each product, and the need to mark each imported item in the specified way. Remember that from next year, all products must comply, regardless of their year of manufacture.

To date, Jim Rowe has discussed the EMC Framework twice in Forum, in the August and November 1997 issues. In August, Jim presented a letter from 'Jim Fixit', a small local manufacturer who made the point that many of his colleagues were largely unaware of their EMC obligations.

Mr Fixit also pointed out that testing an item for compliance typically costs \$2000, and if it fails, this cost is repeated until the item complies. For small volume sales, this cost adds considerably to the price of the item. He was clearly concerned about the future of

his business, and for the industry in general.

European experience

Mr Fixit also referred to an article in the 1996 edition of the UK publication *Electronics World*. It's worth quoting from this article, as it seems Australia is taking an even more draconian approach than Europe:

Our friends down under are soon to experience the joys of Euro-style EMC regulations, with a vengeance. Unlike in Europe, where the issue is yet to be fully resolved, compliance documentation in Australia will be audited on a random basis. This is a 'no-nonsense approach', according to the article.

But the main criticism of the European situation regarding EMC comes from Rod Cooper, in a full page editorial in the same issue of *Electronics World*, under the heading 'Testing time for EMC'. Rod is clearly concerned about the effects of EMC: *What small company can risk such fines, or what individual engineer can risk three months in prison? To a professional engineer this is comparatively more devastating than similar sentences presently being handed out to low-life rapists and muggers, so I am sure the attitude of many engineers and small firms will be 'why bother bringing a new product to the market place in Europe'.*

He goes on to say that he has witnessed the demise of two products due to the new EMC

legislation, caused by the cost and uncertainty of compliance. He suggests that this will happen to such an extent that *many of those useful electronic gadgets and devices produced by small firms — which oil the wheels in industry, commerce and the home — will no longer be brought to market.*

The main thrust of the editorial is summed up by the view: *Common sense should have dictated that the EMC problem can be resolved in a different way from the big-stick approach.* He suggests that tests should be limited to interference emission only, instead of including EMI susceptibility, as products that exhibit this defect are soon found out by market forces:

For example, hi-fi amps that are susceptible to EMI are soon picked out by reviewers in the hi-fi press. With an active consumer press, few products which do not work because of susceptibility to EMI can escape the glare of publicity.

It can work

So are there any positive views of the EMC directive?

In the November Forum, Jim Rowe presented a letter from Sydney design engineer Peter Baxter, who held a more positive view on the EMC debate. According to Peter: *We all have to take that big EMC step and for many it's going to be very frustrating. Do it and you'll become a better designer.*

But as Peter also points out, as part of *his* business, he already has basic EMC test equipment including spectrum analysers, antennas, a shielded room and CISPR standards. Further, he has 'put a lot of effort into becoming educated on EMC issues by going to seminars, joining EMC Network groups and doing a lot of reading'.

He also points out that quite often extra components worth a few dollars will ensure a product complies, although it might take a few thousand dollars to learn the first 'hard lesson'.

In conclusion

No one will argue that there is a pressing need to keep our frequency spectrum as 'clean' as possible. But clearly there is some disagreement about how this should be achieved. Making small businesses keep extensive folders on each product they sell and making individuals liable is hardly stimulating to our local industry. It's surely reasonable to say that this will limit the range of local and imported products, at least in the short term.

The overall effect is difficult to predict. At this stage the ACA is taking a soft approach, but government bodies usually end up wielding the power they are invested with. Whether this will result in prosecutions and bankruptcy for some small businesses is also open to speculation, but our guess is it probably will. ♦

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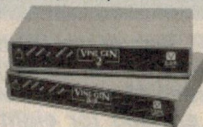


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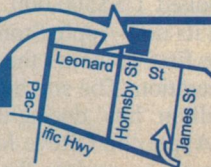
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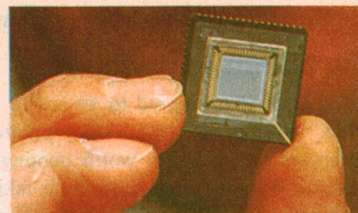
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READER INFO NO.15

Silicon Valley NEWSLETTER



IBM breakthrough in HDD technology

IBM says it has developed a new family of PC hard disk drives based on revolutionary new 'Giant Magnetoresistive' (GMR) drive head technology that will boost storage density to more than 10 billion bits per square inch by 2000. The first drive to deploy the new technology is the Deskstar 16GP, which will set an industry density record with about 2.7 billion bits per square inch.

The Deskstar drive was made available in December and holds 16.8GB (gigabytes) of data, enough for eight hours worth of full-motion video.

Bob Scranton, vice president of technology for IBM's Storage Systems division in San Jose, said that while the data density increase is a remarkable feat in itself, the most important breakthrough in the Deskstar is its GMR head which is able to read and write the tightly spaced data at high speeds. "This breakthrough will allow us to stay on the rapid growth pace of about 60% annual growth in drive storage capacity", Scranton said.

The GMR phenomena was first discovered in 1988. In 1994, IBM was the first to successfully use the discovery to create a super-sensitive sensor for detecting data on a hard disk.

The company said a second higher-speed (7200rpm) Deskstar drive, the 14GXP, will offer up to 14.4GB of storage. Suggested retail pricing for the Deskstar 16GP family ranges from US\$275 for a 3.2GB drive up to \$895 for the 16.8GB model. The high-speed 14GGXP drives will range from US\$675 for a 10.1GB drive to \$845 for the 14.4GB model. IBM also plans to license the GMR technology to other disk drive manufacturers.

Apple's online store does brisk business

Apple Computer reported that it booked US\$500,000 in product orders on its new Apple Store Web site, during the first 12 hours the cyberstore was in operation. The site booked a total of 4.4 million 'hits' during this period.

Apple chief Steve Jobs quickly took to the air to declare the store idea a suc-

cess. "We're thrilled by this immediate customer response to our Apple Store and new G3 (PowerPC 750) computers. Apple is really 'thinking different' about the way we do business", Jobs said, in reference to the company's current 'Think Different' advertising campaign.

Cirrus refocusses struggling PC group

Cirrus Logic's struggling PC chip group has announced it is developing a new chip that combines three previous ICs, an audio chip, a modem chip and a graphics chip into a new 'system-on-a-chip' design that will enable system manufacturers to build advanced consumer oriented computing and entertainment products for less than \$1000.

The PC products division is the only unprofitable division of the four divisions at Cirrus. The company will continue to sell its audio, modem and graphics chips through the transition period. "Our drive is to get out of this highly commoditized, stand-alone market", said spokesman Tom Rigoli.

The integration process will probably take until some time in 2000 to complete. At Comdex in November, Cirrus

and Cyrix showed off a so-called 'Media Centre' (MC) that offers consumers an integrated PC, Internet, television and home entertainment system for less than \$1000.

Digital sells networking group

Digital Equipment has sold its troubled computer-network hardware business to Cabletron Systems for US\$430 million in cash, stock and product credits. Digital's CEO Robert Palmer said it was important to have 'critical mass' in the consolidating network industry. Under the terms of the deal, DEC will sell a set number of the unit's products, as well as other Cabletron products. It will also continue to service them.

The deal leaves DEC flush with cash, as the company recently settled its lawsuit against Intel for about US\$1.5 billion — including \$700 million in cash.

Intel announces sub-\$1000 basic PC

In a move designed to combat the growing consumer interest in sub-\$1000 personal computer and sub-\$500 network computers, Intel said it has



IBM's new Deskstar 16GP, first of the PC hard disk drives taking advantage of the firm's 'Giant Magnetoresistive' (GMR) head technology. Measuring only 101.6 x 146 x 25.4mm, it uses 10 platters rotating at 5400rpm to deliver a capacity of 16.8 gigabytes — enough for eight hours of MPEG2 video! The GMR heads provide a recording density of 2.687 billion bits per square inch.

designed several new computer systems based on new variants of the firm's MMX and Pentium II chip that will be able to compete in this booming market.

The new 'Basic PC' systems will be priced at less than US\$1000 — despite featuring powerful processors. To achieve the needed profit margins, Intel has redesigned the chips to handle functions that are currently handled by separate chips or hardware accessories, including a modem and soundcard.

"To help get the cost out of the system, we have to focus on soft everything", said Mike Ayers, vice president of Intel's Desktop Product Division — which will produce the Basic PCs for OEM customers.

Analysts said the Basic PC moves Intel back to the idea of 'native processing', a controversial plan in which Intel envisioned incorporating many multimedia functions onto its processor. That move was opposed by Microsoft, as the plan conflicted with Microsoft's Windows 95 plans. After a brief battle, Intel dropped most of the native processing program.

MCI accepts US\$37B Worldcom merger offer

After evaluating competing bids from GTE, British Telecom and WorldCom, US long distance carrier MCI announced it has chosen to accept the WorldCom merger offer. The latter had increased its bid to US\$37 billion, making it the biggest merger in US history.

The combined company, to be known as MCI WorldCom, will have 22 million telephone and Internet customers in more than 200 countries and an expected US\$32 billion in 1998 revenues. MCI chairman Bert Roberts will remain in that position at the combined company.

British Telecom will receive US\$7 billion in cash from WorldCom for its 20% interest in MCI, representing a profit of \$2.25 billion on its MCI stock. It will also receive \$465 million because MCI broke its previous contract to merge with BT.

Fairchild returns home...

Less than a year after being set free, Fairchild Semiconductor is returning to its birthplace on Ellis Street in Mountain View, Silicon Valley.

In a US\$120 million deal, Fairchild — the granddaddy of Silicon Valley's chip industry — has agreed to take over the semiconductor operations of defence contractor Raytheon. The unit's manufacturing operations are located but a stone's throw from the old rust-coloured Fairchild Semiconductor headquarters,

Internet commerce will 'explode', says Cisco chief

Cisco Systems chief executive officer John Chambers has told a large gathering of Asian and American business leaders in Silicon Valley that electronic commerce will grow into a trillion-dollar-plus market in the next couple of years.

"The Internet is going to change everything, and at a pace we've never seen before. Companies who don't know how to use high-tech will be left behind. Those that do know how to use the Internet stand to get rich at cyberspace speed", Chambers said, in his keynote address at the Asia-Pacific Information Technology Summit in San Jose.

Chambers said Cisco Systems is a prime example, having grown in just seven years since its founding to US\$7 billion in annual sales, with 40% coming from Internet sources. Chambers repeated his prediction, made during Comdex, that Cisco will do more than US\$20 billion in sales in the year 2000.

Time is shrinking rapidly, Chambers told the audience. "What took the industrial revolution to accomplish in the 200 years up to this point, will be rivalled in the next 20 years because of the Internet revolution. We are a virtual factory. We recently presented a report to our board of directors showing that we can triple our size without increasing the number of manufacturing employees."

Chambers said one indication that the momentum towards the Internet has shifted into high gear is that companies across the United States today are spending a record 43% of their capital investment budgets on high-tech gear, up from just 7% in 1970.

which remain abandoned a decade after the company moved out.

Fairchild executive VP Dan Boxer said the company intends to maintain its headquarters in South Portland in the state of Maine, where it moved after National Semiconductor spun off the Fairchild group as an independent company earlier last year.

The Raytheon unit has about 420 employees and about US\$76 million in annual revenues. The Raytheon unit manufactures low-cost analog and mixed-signal ICs, and Boxer said the unit's operations and products make a good fit with National's digital logic and memory products.

Toshiba pulls out of US home PC market

Humbled by the blistering speed at which traditional US PC manufacturers introduce new machines and cut prices, Toshiba announced it is pulling out of the vast US desktop PC market where it had hoped to lure consumers with its award-winning Infinia line. Market researchers said they won't be too surprised if the other major Japanese PC maker with interest in the US home PC market, Sony, follows suit soon.

When they entered the US market a year earlier, it was widely expected that the two firms with their expertise in consumer marketing, design and name recognition would carve a large piece of the US consumer PC market pie.

Toshiba's move came a week after the Infinia received the PC industry's most sought-after product award, an 'Editor's Choice' prize from *PC Magazine*. But at prices ranging from US\$1800 to \$3400, the Infinia lost out to the scores of brand

name and no-name systems selling for \$800-\$1200 offering much of the same power and features.

Toshiba and Sony may have overlooked other basic facts about the PC market when they entered the US market. "It's a very different business from consumer electronics. PCs require a lot of service and support, and the products change every six months or so. The PC isn't a television", said Tim Bajarin, president of Creative Strategies.

Are Taiwan's chipmakers risking too much?

Taiwan's semiconductor makers say they are planning to invest a combined US\$80 billion to build nearly 30 highly-sophisticated 8" and 12" wafer fabrication facilities over the next 10 years.

The announcement has raised eyebrows in the US, where market researchers have pointed out that the investments represent a huge gamble at a time when most of the industry has slowed the pace of plant and equipment investments in the face of low profit margins in several key markets, such as DRAMs. The global chip market will barely top US\$300 billion in 2001, according to the Semiconductor Industry Association's most recent estimates.

Still, Taiwanese industry and government officials remain bullish about the future. For example, Taiwan's Industrial Technology Research Institute President Chintay Shih said that the outlook for the chip industry looks as bright as ever, adding that the global chip industry should grow 800% over the next decade, with US\$66 billion in new profits by 2005. Taiwan's 2.9% slice of world market share will increase to 8% in 2005, he added. ♦

UPN LASER DATA TRANSCEIVER

Melbourne firm Realtime Control has developed an interesting optical data transceiver, which they're making available in a variety of forms — including a low cost kit. It's designed to operate transparently as an optical modem, and could easily be used to implement the physical layer links for a 'ubiquitous public network'.

by **JIM ROWE**

Using light beams (generally infra-red) instead of cables to convey computer data is becoming more and more popular, especially in local area networking situations. IR links using the IrDA (Infra-red Data Association) standard are being used increasingly for hooking laptops and handhelds into LANs and office printers, and apparently some ISPs are even using IR beams to implement their local loops.

One advantage of IR links over other wireless technologies is that they offer greater security and resistance to EM interference. However on the down side they generally require a line-of-site path and careful alignment. They're also subject to link degradation from weather conditions, interruptions due to birds and so on — calling for error correcting protocols.

At present, most IR data transceivers are

built directly into recent-model computers and peripherals. If you want to build up your own links for existing equipment using add-on units, they're not too thick on the ground. That's what Dr Derek Weston, the principal of Williamstown (Vic.) firm Realtime Control, found when he wanted some for a data systems project. He even tried a few existing kit designs, but found that they didn't provide the operating speed, ease of alignment, reliability or range he needed. So he ended up having to design his own transceiver module: the UPNLT.

From information I gleaned from Dr Weston's Web site (<http://www.alpha-link.com.au/~derekw/realtime.html>), it appears that the UPNLT has been developed as a 'building block' for a proposed 'ubiquitous public network' or UPN. This

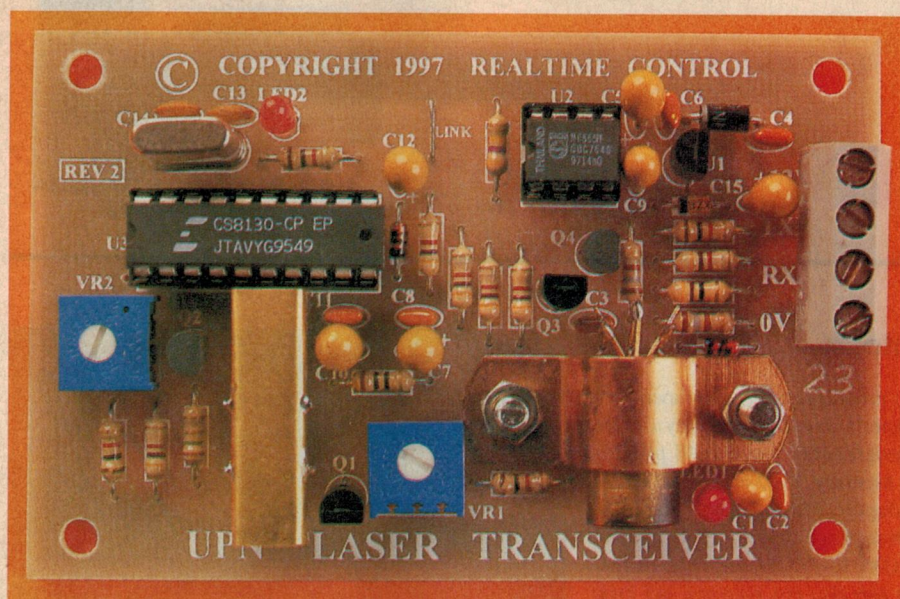
would have a large number of small and low cost switching and routing modules, many of them linked via a network of laser transceivers to form a 'people's network'. In other words, one important intended application for the module is to implement the physical layer links for much of the UPN — but this also means that it's eminently suited for linking the COM ports of any two computers, within its range.

In keeping with this proposal, the UPNLT has been designed so that after it's initialised, it presents a 'transparent' data comms link — very similar to a modem. In fact a pair of UPNLTs essentially behave as a pair of optical modems, providing a full-duplex data connection over many hundreds of metres, and at data rates up to 115.2kb/s.

The actual specs of the UPNLT are



The transceiver module shown larger than actual size. The transmitting laser is visible at right; the receiving diode is under the inverted-U shield at left.



A view from above. The only off-board connections are for power and serial transmit/receive data.

quite impressive. A pair of transceivers can be configured to operate at any standard data rate from 1200b/s to 115.2kb/s, in full duplex mode and over a range of up to 500 metres — internally, or externally in clear weather. This is without additional lenses, although the recommended maximum range for reliable operation through two clean clear-glass windows is 450m.

Although the UPNLT conforms to the IrDA's SIR (serial IR physical layer link) modulation/encoding specification, it actually uses visible red light at 670nm. I imagine this is to allow more convenient visual link alignment. The semiconductor laser used is rated at less than 5mW peak pulse output (typically 2.8mW), and has a beam cross section of about 75 x 150mm at 500 metres.

The UPNLT's computer interface is essentially RS-232C, although the signal lines don't swing negative. In most cases this won't be of any consequence, though, as virtually all modern computer serial ports treat a 0V signal as a negative signal.

At the heart of the UPNLT is a Crystal Semiconductor CS8130-CP, a dedicated multi-standard data transceiver/codec device which is in this case configured to provide IrDA SIR modulation and demodulation. The CS8130 is connected to the laser and its feedback diode via discrete transistors, for low cost; the receiving photodiode connects directly to the CS8130. Discrete circuitry is also used for the computer interface.

An interesting aspect of the module is that for the first seven seconds after power-up, an on-board 555 timer holds the CS8130 in its configuration mode — in which it interprets incoming data as a configuration string. After that, the CS8130 is switched to transparent data transfer mode. So the attached computer needs to

send a configuration string to the UPNLT module within seven seconds of power-up, if it's to be effective. The string must be sent at the default rate of 9600b/s.

Realtime Control gives details of the required initialisation string on its Web site, and also gives a sample initialising program in QBASIC, to show how easily it's done.

Compact module

All of the parts for the basic UPNLT transceiver fit on a compact PC board measuring 89 x 57mm. The transmitting laser is mounted directly on the PCB via a small 'C' clamp, while the receiving photodiode also mounts directly on the board with a small 'inverted-U' hood of shim brass over it to act as an optical shield. All power and data connections to the module are via a four-way terminal block fitted to one end of the board.

It operates from 9-12V DC, which can come from a suitable battery or 'plug pack' supply. The current drain is typically 60mA.

Realtime Control is very flexible when it comes to making the UPNLT module available. There are four levels of hardware kit, with the simplest UT0 kit consisting of only the bare PCB — you have to provide everything else.

Then there's the UT1 kit, which provides the PCB and all of the on-board components including the laser. In this case you have to assemble the module, perform the testing and adjustment procedures, provide a case and power supply and make up the necessary cables.

With the UT2 kit, you get the PCB module fully assembled and tested, but again without case, power supply and cables.

Finally there's the UT3 kit, in which the assembled and tested PCB is provided fit-

ted into a diecast case and complete with a 10m data cable with DB9 connector for the computer's serial port, a connector for a standard DC power supply input and also a mounting bracket. The only item left for you to provide is a power supply.

The quoted prices for these UPNLT kits are \$40 including P&P for UT0; \$159 plus P&P for the UT1; \$279 plus P&P for the UT2; and \$389 plus P&P for the UT3. The P&P for the three latter kits is \$8 within Australia, but either \$12 (UT1, 2) or \$16 (UT3) outside Australia because of the higher postage.

Although we didn't have the opportunity to try out a pair of UPNLT modules 'in anger' as a data link, by the time I had to write this article, our impressions are that the module has been very well designed. It appears to be capable of very practical and effective use as a 'short haul' direct-path optical modem, and should therefore be of interest to anyone who needs this kind of high-speed optical link.

Those like Dr Weston who are keen to establish a low-cost 'ubiquitous public network' should also find the UPNLTs very suitable for implementing many of its physical layer links...

By the way, Dr Weston also seems to be well advanced in the development of low-cost data switching and routing modules for a UPN — so if you find this innovative concept of interest, I suggest you have a look at Realtime Control's Web site. ♦

UPN Laser Transceiver

A high speed full-duplex optical data transceiver capable of operating at speeds of up to 115.2kb/s over a range of up to 450m (direct line of sight, through two clean clear glass windows). Uses IrDA SIR modulation/demodulation protocols.

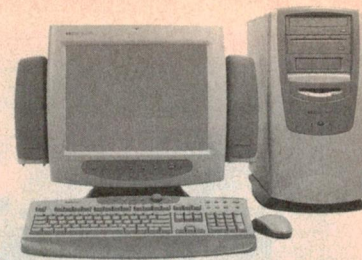
Good points: Uses visible 670nm red light for easy visual link alignment. Simple arrangement for power-up configuration via a data string. Available in relatively low cost kit form. Range can be extended using optical enhancements. Plenty of support via the Realtime Control Web site.

Bad points: Nothing significant.

Price: From \$40 incl P&P for a bare PCB, to \$389 plus \$8 P&P for a fully built up and tested unit in case.

Available: Realtime Control, PO Box 312, Williamstown Vic 3016. Phone (03) 9397 5523; email derekw@alphalink.com.au.

Computer News and New Products



Universal programmer suits laptops

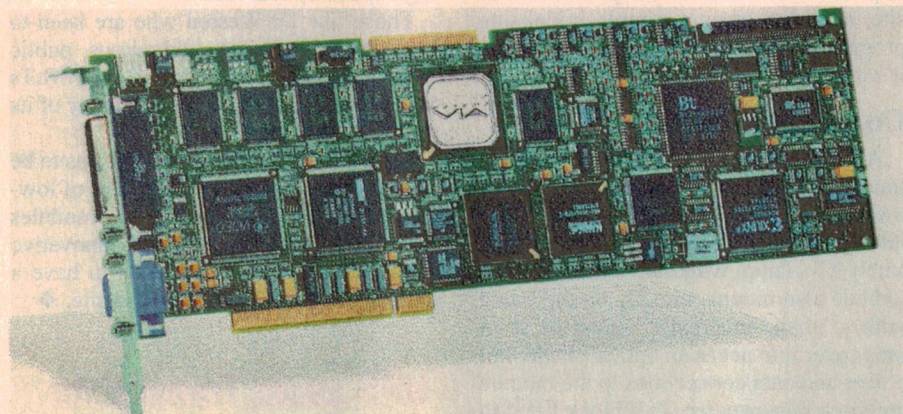
The Xeltek Superpro range of universal device programmers is now available in Australia. Because they work through a computer's parallel port, they can be used with a laptop computer. The Superpro III programmer features 48 pin-drivers and support for over 4000 devices, including memory, PLD and MCU chips. The product comes with a standard 48-pin DIP adaptor, with others available on request. The one adaptor suits all devices for each package type.

The programmer can be used with BROM, EPROM, EEPROM and Flash memory ICs, plus a range of microcontrollers (MCU). It can also test memory and logic devices. Smaller programmer models are also available, with some costing under \$500.

For further information circle 168 on the reader service coupon or contact Advanced Solutions, 47 Karril Avenue, Beecroft 2119; phone (02) 9872 1981.



24-bit colour PCI frame grabber



The Matrox Imaging Products Group has released the Matrox Corona, a new PCI frame grabber card claimed to have advanced true-colour acquisition and display

capabilities. It provides up to 24-bit colour capture from component or composite sources, as well as monochrome. Capture from a digital video source is possible in either TTL or RS-422 format for interfacing to a range of input devices.

Video data is simultaneously captured to on-board display WRAM and transferred to host memory in real time, at over 100MB/s. Its single board is claimed to replace the multiple boards otherwise needed in image analysis, medical imaging, and machine vision units. Application development for the card is accomplished using the Matrox imaging library. Development tools include a Windows-based camera configuration utility and an interactive prototyping package.

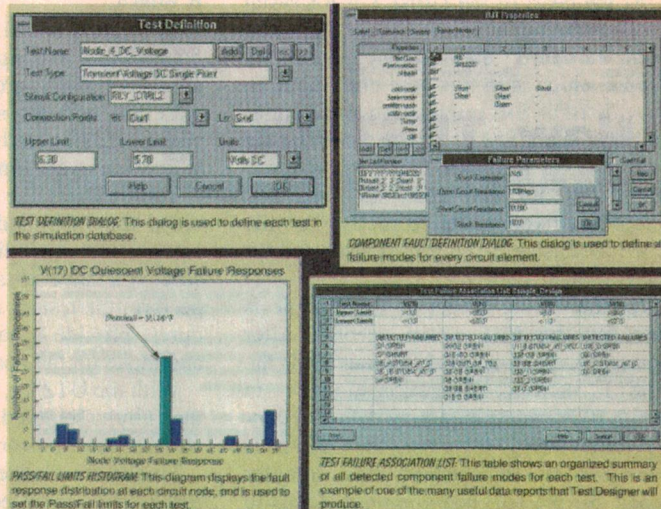
For further information circle 163 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133.

Circuit simulator has pass/fail facility

Intusoft has announced Test Designer, an analog and mixed signal circuit simulation tool. This SPICE-3 based simulator provides nominal response parameter values (DC volts, AC volts, etc) at each circuit node for any user defined stimuli, such as any custom voltage or current waveform. These can be developed with the on-line screen editor, or selected from predefined DC or AC sinewave voltages or currents. It computes the expected spread for each parameter, and assists in establishing reasonable pass/fail criteria.

Once test measurement parameters are established, pass/fail limits can be entered as 'hard' values from the keyboard, or the simulator can compute and plot the expected range of test parameter values given the component tolerances. The program displays nominal circuit performance and failed circuit performance for any or all failure modes at each circuit node. The simulator includes schematic entry capability, over 8000 Spice models, and a graphical waveform analyser.

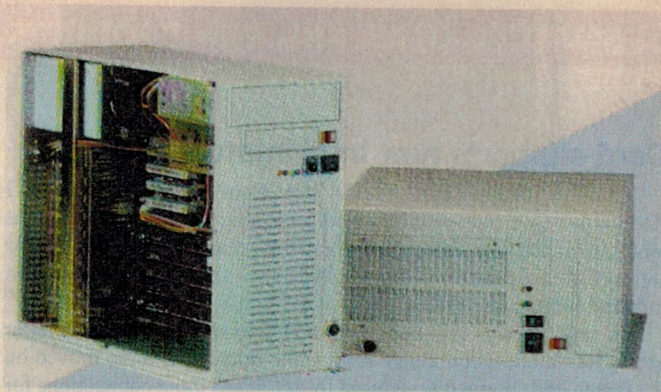
For further information circle 164 on the reader service coupon or contact ME Technologies, PO Box 50, Dyers Crossing 2429.



Industrial PC benchtop and wall mount chassis

Intelligent Systems Australia has released the IAC-C808FA and the IAC-C810FA, a full size benchtop and a wall mount chassis respectively. Both units support an eight to 10-slot backplane or a baby-AT motherboard. There's space for two 3.5" and one 5.25" disk drives, and they support PS/2 type power supplies, or redundant power supplies. The units are suitable for industrial conditions as a replacement where a rack mount unit is not suitable. Both units support two cooling fans, and are designed for harsh conditions.

For further information circle 166 on the reader service coupon or contact Intelligent Systems Australia, PO Box 118, Berwick 3806.



12MB Flash disk module

The new AP-10436 from Intelligent Systems Australia is a Flash disk card with a highly integrated Flash memory module. The interface allows a computer to issue commands to read or write blocks of memory in the Flash memory array through an IDE port, without additional software or drivers. It also complies with the personal computer memory card international association ATA (PC card ATA) standard.

The card has a 1MB - 12MB memory capacity (standard size is 4MB) and up to four units can be run from a two-channel IDE interface. It has a low CMOS power consumption, +5V operation, automatic

error correction and retry. A PC/104 interface is optional.

For further information circle 162 on the reader service coupon or contact Intelligent Systems Australia, PO Box 118, Berwick 3806.

Boxed processor suits resellers

AMD has announced a boxed processor product based on the AMD-K6 processor, for Socket 7 systems. The new product includes the AMD-K6/200 or 233 in a boxed unit, with heatsink, thermal grease, and fan attached to the processor. It comes with a three-year limited warranty.

According to a company spokesperson: "The reseller market has responded well to the AMD-K6 processor, and this new product will let value-added resellers more easily build the best desktop PCs for their customers."

AMD has also announced the expansion of its distribution network with the addition of several new distributors. In Australia, APD International will be distributing the AMD processor in a box, and Datamatic will distribute it in New Zealand.

For further information circle 167 on the reader service coupon or contact AMD Australia, Level 14, 33 Berry Street, North Sydney 2060.

48 pin-drivers, truly Universal Programmer



A lot of low-cost programmers claim to be 'universal', but when you want to program a 40-pin MCU you have to buy an adapter. The Xeltek SUPERPRO III is truly universal, with individual pin-drivers for each of its 48 pins. Runs from a parallel port—great for notebooks as well as desktop PCs. Less than \$1000 (tax paid). Smaller units and EPROM emulators are also available.

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Card supports new Intel InterCast system

The new miroMEDIA PCTV Pro from Miro Products AG (Germany) is a plug-in multimedia auxiliary card for a PC that lets you watch television, InterCast broadcasts, listen to CDs or stereo FM radio while using the PC. It includes videotext and an infrared remote control.

The card features PCI busmaster technology for fast data transfer and allows a television image from cable or antenna to be moved on the screen and enlarged or reduced to suit. It has input connections for S-Video (S-VHS, Hi8) and composite video (VHS, Video8) for use with a video recorder or camcorder.

An integrated capture function allows a television or camera image to be stored on a hard drive. The infrared remote control lets you change between TV, radio, screen text, video or CD, control the volume, switch between radio stations or change the television window.

The PCTV Pro supports Intel's InterCast technology (INTERnet + broadCAST), soon to be available on commercial TV in Australia. This system is transmitted on the usual television signal and is specific to each TV station. It allows Web pages to be transmitted with TV programs. The RRP is \$380.

miroMEDIA PCTV pro
TV/RADIO TUNER & CAPTURE BOARD
CARTE TUNER TV/RADIO ET D'ACQUISITION

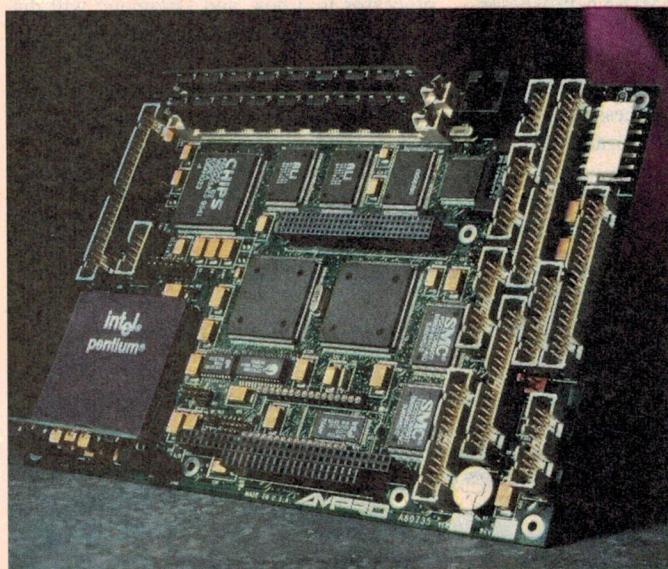
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For further information circle 161 on the reader service coupon or contact Lako Vision, 2/3 Wellington Street, Kew 3101.



'Little Board' Pentium computer

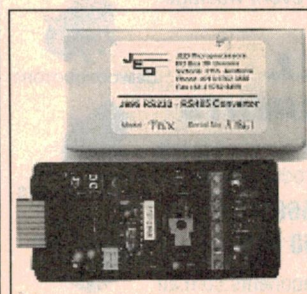
Ampro Computers has announced its new Pentium-based single-board computer in a compact 'little board' form-factor (146 x 203mm). It is based on a 166MHz Pentium CPU and a PCI-enhanced version of PC/104, and especially suits medical system applications or where the size of a backplane-based architecture is not suitable.

The board has four serial and parallel I/O ports, floppy and enhanced-IDE drive interfaces, PCI UltraSCSI, 10BaseT Ethernet, and a GUI-accelerated PCI LCD/CRT Super VGA display controller. It also has a bootable solid-state disk, ruggedised embedded-PC BIOS, a watchdog timer, a power monitor and other enhancements.

It can also be augmented via the onboard PC/104-Plus stack location. PC/104-Plus is a new 32-bit PCI-enhanced version of the PC/104 self-stacking embedded module standard, and now includes two expansion buses (ISA and PCI). Several full motion video capture and overlay modules are available from third-party suppliers for medical system applications requiring video image capture and/or overlay.

For further information circle 165 on the reader service coupon or contact Micromax P/L, 307 Keira Street, Wollongong 2500. ♦

Automatic RS232/485 CONVERTER



The small plastic case, 100mm by 50mm by 25mm to the left is an Australian built RS232 to RS485 converter. This connects to a PC or a PLC with an RS232 serial port and interfaces it to an RS485 cable, which can be up to 4,000ft long, with input and output devices along its length. The J995X is a fully automatic converter which has a built-in micro-processor to automatically connect the transmitter to line, so the user program does not need to control the RTS line.

Cost: \$160, plus \$20 plug pack.

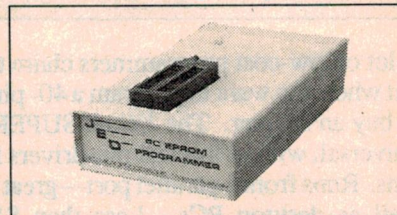
JED Microprocessors Pty. Ltd

Office 7, 5/7 Chandler Road, Boronia, Vic., 3155. Phone: (03) 9762 3588 Fax: (03) 9762 5499

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WEBWATCH



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The Hardware Book

<http://www.blackdown.org/~hwb/hwb.html>

Whether you are looking for the details of your dishwasher's serial port (don't laugh...), need to know the pinout of a SCART video socket or just want to know how to wire up a null-modem cable, Joakim Vgren's Hardware Book is the place to find it. He calls it the Internet's largest free collection of connector pinouts and cable descriptions, and you'll be hard pressed to *not* find what you are looking for. A whole page is devoted to each of the hundreds of cables, plugs, sockets and connectors, and almost every item contains a hardware description, a table listing the pinouts as well as revisions and updates for the connector concerned.

There's info on how to build adapters and converter cables, pinouts for connectors, buses etc., as well as a limited list of circuits and data tables. Of course Joakim is more than happy to accept any information you might have, so if you've just spent the night nutting out the comms port on your Kenwood DPM7750 CD player, he'd love to hear from you.

Intusoft's home page

<http://www.intusoft.com/>

If you are in the business of circuit design these days, then you are almost certainly aware of the abundance of SPICE-based circuit simulation software available. Intusoft have been in the simulation game for years, and their site contains much useful information on SPICE, and of course many, many files to download.

You can get a fully working evaluation version of the ICAP/4Windows simulation software ICAP4Demo V8.0 for Win95 or NT, or get version 7.6 which runs under Windows 3.1x.

You can also try out a demo of the FilterMaster and SpiceMod products, as well as other analog and mixed signal simulation software — and there's even a multimedia tutorial movie to teach you how to use ICAP/4.

While most of these files are quite large (6-8MB each), most of them are thoughtfully available in 1MB chunks to make downloading easier. All the latest demo/evaluation version model libraries are available, along with all of Intusoft's newsletters for the last two years, plus heaps of technical articles and a healthy link list to sites with component models, engineering sites and engineering magazines.

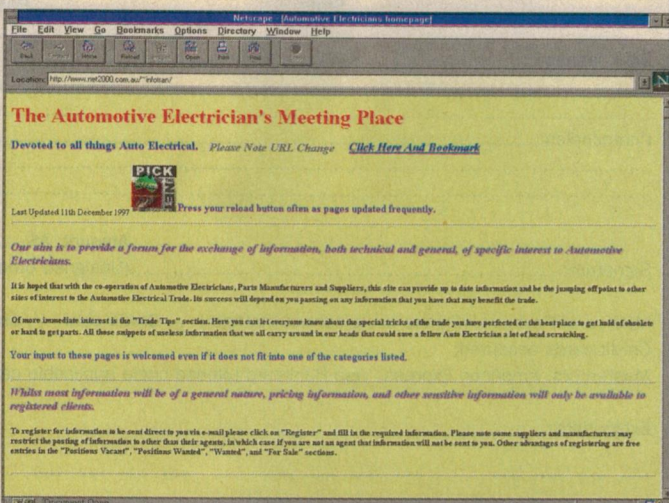
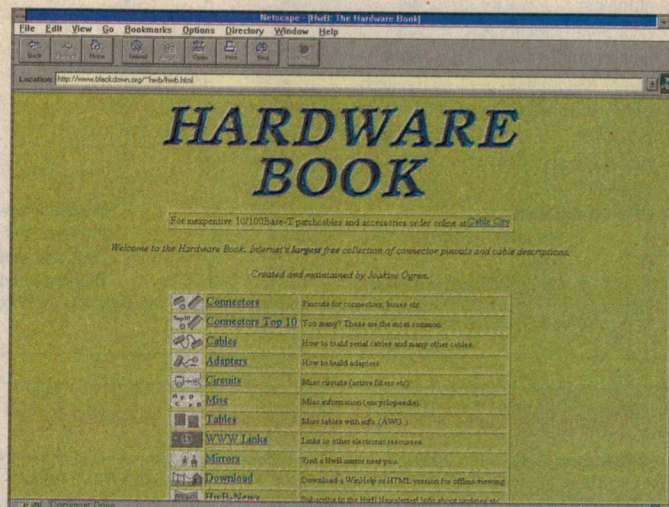
The automotive electrician's meeting place

<http://www.net2000.com.au/~infotran/>

Automotive electronics is a rapidly growing field, and this Australian site aims to help people around the world to get together and exchange information on all things automotive and electrical. Check out the Trade Tips section for hints, tips and inside info, and even submit your own tricks and ideas to help other readers.

What will probably be of great interest to most readers is the 'What's Your Problem Then?' questions and answers page. Here you can submit the details of your car's electrical problem to a general forum, and read (or even answer!) queries by other readers. If you register with the site you take advantage of many extra benefits, including entries in the positions vacant/wanted and for sale/wanted sections, and add your company to the automotive electricians' business directory.

It seems to be a well designed site which isn't bogged down with heaps of pictures — instead, you get a fast, popular site with relevant up to date information of use to both the auto electrician and the general public. ♦



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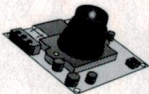
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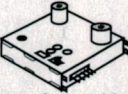
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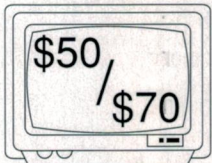
New kit, now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: \$30 - \$20
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SPECIAL introductory price of.... \$199



SOLAR REGULATOR

Ref: EA Nov/Dec 94 (intelligent battery charger). Efficiently charge 12-24V batteries from solar panels, can also be used with simple car battery chargers to prevent over-charging. 7.5A or 15A kit: NOW \$26 / \$29

CCD IMAGE SENSOR

High quality "Thomson" brand 2/3" CCD image sensor, type TH7863, with full data but no, usable response from 400 to 1100nm, 12000 dynamic range, 2/3" optics compatible format: \$35.....(IC application notes may be available soon)

NICAD BATTERY SPECIAL

New 1.2V-400mAh cells wired in packs of 6, each pack has a thermal cut out switch, each cell is 16X45X5mm, as used in mobile phones, 5 packs (30batteries) for: \$10

NETWORK 2 COMPUTERS FOR \$50!!

New Windows/95 compatible (DEC (DE101) etherworks LC/TP) DIGITAL brand Ethernet computer cards with software and booklet in original box. Cards include boot ROM so one of the computers does not even require a hard disc. We don't supply the commonly available cable which can also be made up with RJ45 connectors and two twisted wire pairs: Diagram included. Limited quantity: \$50 for a pair.

VIDEO TELESCOPE FOR P.I.'S REMOTE VIDEO SURVEILLANCE

A suitable adaptor + a used 35mm lens. Excellent for low angle and low light conditions. Would suit P.I.'s or hobby Astronomers. **Amazing performance at great distances.**

DISPLAY

12 large 5x7 LED dot matrices (38 X 52 mm), very bright, metal housing, 240Vac power, 3 wire control lead, no info: \$40.



12V/7Ah GEL BATTERY BARGAIN

Fresh stock standard battery plus one GEL/LEAD-ACID BATTERY CHARGER for: \$30

NEW!!! COMPUTER CONTROLLED STEPPER MOTOR KIT

New improved kit that can drive larger motors and has optoisolation between the circuit and the computer. DB25 connector provided on PCB. Needs a standard cable for connection to a PC, and a power supply for the motor drive section. PCB and all on board components kit plus software and notes: \$39 or \$49 with two used 1.8deg. motors !!!

CGA COLOUR MONITOR

New 12V DC-1A 6" colour monitor, ready for enclosing, no box, just the tube and driver PCB's: \$65

DC MOTOR SPEED CONTROL EXPERIMENTERS PACK

ONE 20A motor speed controller kit (similar to SC - Jun.97-\$18) plus two small new 12VDC motors (40mm dia., 40mm length) plus one used car windscreen wiper motor (which have internal gear reduction) for: \$32

NEW SEMICONDUCTOR BARGAINS

2SK2175 - MOSFETS 15A, TO220, 60V, 30W: 10 for \$15, CA3140 - MOSFET input op amp : 5 for \$5, TL494 - switchmode power supply IC : 5 for \$5, NE555 - timer IC : 10 for \$5, ICL7106 - LCD display driver : \$5, ICL7107 - LED display driver : \$5, IRFZ44 MOSFETS 60V, 0.028ohm on resistance, 50A: 10 for \$30 C8050 and C8550 transistors: 20 for \$5, CMOS IC'S 4001/ 11/ 13/ 16/ 17/ 20/ 24/ 28/ 40/ 46/ 60/ 66/ 69/ 93 Any mixture 10 for \$8

GREEN DIODE LASER HEADS

Green 532nm output heads. Very bright output at the peak response of a human eye, much brighter than equal powered blue Argon lasers. These employ an IR laser diode pumping a Yag rod, the output of which is applied to a frequency doubling crystal. Require an adjustable constant current source: 10mW head \$1400, 20mW head \$2020 Suitable constant current source kit plus supply plus fan: Approx \$35.

A LICENCE WOULD BE REQUIRED FOR THIS PRODUCT.

UNIDIRECTIONAL ELECTRET MICROPHONE

New quality product with clip, 3M lead, 2.5mm plug: \$4 Make a stage quality wireless microphone by combining it with our FMTX MK2 trans-mitter kit: \$16 for the kit plus the microphone



DOG SILENCER

We have a new improved high power swept ultrasonic generator kit that can drive up to 4 piezo tweeters. Works on dogs and most animals. PCB and all on-board components and horn piezo tweeter: \$33, extra tweeters \$7 ea. Suitable 13.8V-1A DC plugpack \$10.

VISIBLE LASER DIODE MODULE KIT

This 5mW/650nm kit has the same circuit as our "visible laser diode kit" but has a much smaller PCB. Overall dimensions of the module are 15mm X 40mm long: \$26

AUTOMATIC LASER LIGHT SHOW KIT

A laser display that changes every 5 - 60 seconds, and the time is manually adjustable. There are countless possible interesting displays which vary from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. PCB, all on board components, three small DC motors & mirrors : \$77 Combine it with above module kit for a total of \$89!!

CALLER ID

See the phone No. of your incoming calls displayed on a LCD screen when the phone rings. Has 90 call memory and a dialler: \$55. Also available is a complete phone with caller ID: \$99

650nm VISIBLE LASER POINTER KIT

Complete laser pointer that works from 3-4V DC. Includes 650nm/5mW laser diode, new handheld case 125 x 39 x 25mm, adjustable collimator lens PCB battery holder: \$28

650nm LASER POINTER SPECIAL

Light weight (2XAAA) pen sized pointer with 5mW/650nm laser diode, 140mm long, 18mm diameter: \$50

NICAD CHARGER & DISCHARGER

High quality assembled switch-mode 7.2V Nicad Charger and Discharger PCB assembly only. Requires an unregulated input of 13.7V DC @ 900mA. Appears to use voltage drop detection to end charge, also a timer to end the charge. We supply a thermistor for temperature sensing. For fast charging 7.2V AA nicads. Basic information provided, Incredible pricing: \$9 ea or 3 for \$21.

LONG RANGE UHF REMOTE CONTROL

We have new very small UHF Super-heterodyne receiver modules and matching Saw resonators on 433.92 MHz. (25mW power limit!). The range of our proto- type Tx-Rx was approx. 1km! The first will be a 2 ch. remote control for approx. \$55: (1 Tx + 1 Rx.) ... Available late Feb.

HELIUM NEON LASER BARGAINS

Large 2-3mW He-Ne laser head plus a compact potted US made laser power supply. The head plugs into the supply, and two wires are connected to 240V mains. Needs 3-6V/5mA DC to enable: \$100. Also 5mW tubes plus a 12V inverter kit: \$80

STEPPER MOTOR DRIVER KITS

Kit includes a large used 1.8deg. (200 step / rev) motor and used SAA1042A IC. Can be driven by external or an on-board clock; has a variable frequency clock generator. External switches (not provided) or logic levels from a computer etc determine CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and all on-board components: \$18 for kit with 1 motor, \$28 for kit with 2 motors.

SWITCH MODE POWER SUPPLY

Compact (50 x 360 x 380mm), in a perforated metal case, 240V AC in, 12V DC/2A and 5VDC/5A out: \$17

BRAND NEW LASER ENGINE

complete laser engine as used in laser printers. Includes a Poly- gon scanner motor with Xtal controlled driver PCB, 5mW/780nm laser diode in collimated housing mirrors, lenses etc. Info on how to make the motor and laser operational included. Bargain at \$35

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors and components kit \$15. Suitable plugpack: \$6 Weather-proof box: \$2.50. Box for power supply: \$2.50 Rabbit-ears antenna: \$7 (MAR-6 available separately)

12V DC LIGHTING SPECIAL

A very efficient and properly driven fluorescent white light! Tubes last because the filaments are heated! Inverter kit can drive up to three 11W Compact Fluorescent lamps (CFL's). One kit plus one 11W CFL \$25. extra CFL \$11Ea.

LEARNING UHF REMOTE CONTROL

NEW!! This small ready made key-chain transmitter that can learn up to 4 channels from almost any (Not code hopping) UHF remote control in the range of 280-460MHz! No track cutting or DIP switches. With tuning LED: \$39

650nm LASER MODULE

New module, fitted with a 650nm laser diode! Very small, 35mm long, 10mm diameter, 3 to 4.5V operation: \$45

SUPER BRIGHT BLUE LEDS

THE BRIGHTEST EVER OFFERED, Super bright at 400mCd \$1.50 ea. 10 for \$10...5mm LEDS AT SUPER PRICES 1Cd red 10 for \$4...300mCd green \$1.10 ea. or 10 for \$7...3Cd red \$1.10 ea. or 10 for \$7...3Cd yellow also in 3mm: 10 for \$9; Super bright...FLASHING LEDS: \$1.50 ea. or 10 for \$10...(Make small torch! mix the red green & blue)

MORE KITS

Geiger counter: \$40...Breath tester: \$40...Music box: \$11...Ding dong doorbell: \$3.50, Siren using a 10cm speaker: \$14...Electric fence using used car coil: \$25...Ultrasonic car alarm: \$35...1ch UHF Central locking, Tx and Rx: \$35...4 door Central locking: \$60...2 Channel UHF Remote Control, 1Tx + 1Rx: \$45.

LCD CHARACTER DISPLAYS

In stock! Standard 4 line X 32 char. displays using NEC D7272G IC's: \$18

AUDIO LASER SCANNER KIT

Generate Great patterns that depend on the sound or music picked up by an electret microphone. Inc. PCB, components microphone, 2 motors & 2 mirrors: \$44

LARGE SUPPLY FOR THE STEPPER DRIVER.....USED POWER SUPPLIES

Partially enclosed, uses "C" core transformer with shield. Primary taps: 100-200-220-240V, sec- ondaries: 24V- 8.5A , 9.5V-1.5A, 9.5V- 4A, 5KG, mains filter, switch, 4 fuse- holders, 3 bridge rectifiers, and filter capacitors: \$15,

NICKEL METAL HYDRIDE (NiMH) RECHARGEABLE 1.2V CELLS

similar to NiCads but higher capacity, removed from new equipment, guaranteed, 48mm X 16mm diam.: 8 for \$4

115VAC "MUFFIN" FANS NEW

50/60Hz, 0.20A, shaded pole motor, metal, plastic blade, 40mm thick: \$4.

DIGITAL BAR CODE WANDS

New USA made wands with a Sapphire tip, curly cord & 5pin DIN plug. converts bar codes to a digital pulses when swept across the bar code, 0.19mm spot size is. Open collector output TTL/CMOS compatible needs 5V supply. \$45

MOTOR PROTECTORS / MONITORS:

protects 3 phase motors up to 1000V / 1000A against thermal overload, mechanical overload, & electrical fault conditions, can be used as a shearpin, consists of a motor protection unit with built in current transformers (motor wires pass through- no physical connection to motor wires), a 3m cable linking it to a monitor unit with a 6 digit LCD, settings & the trip cause if it occurs, industrial quality, made in Holland, new & at a fraction of normal cost: \$200 for the pair.

MAGNIFIERS / LOUPES

Small jewellers eye- piece with a plastic lens: \$3... 50mm \$8, 75mm \$12... 110mm \$15. SPECIAL: Buy the set of four magnifiers for a total price of \$25.

OATLEY ELECTRONICS

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